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Electrical World

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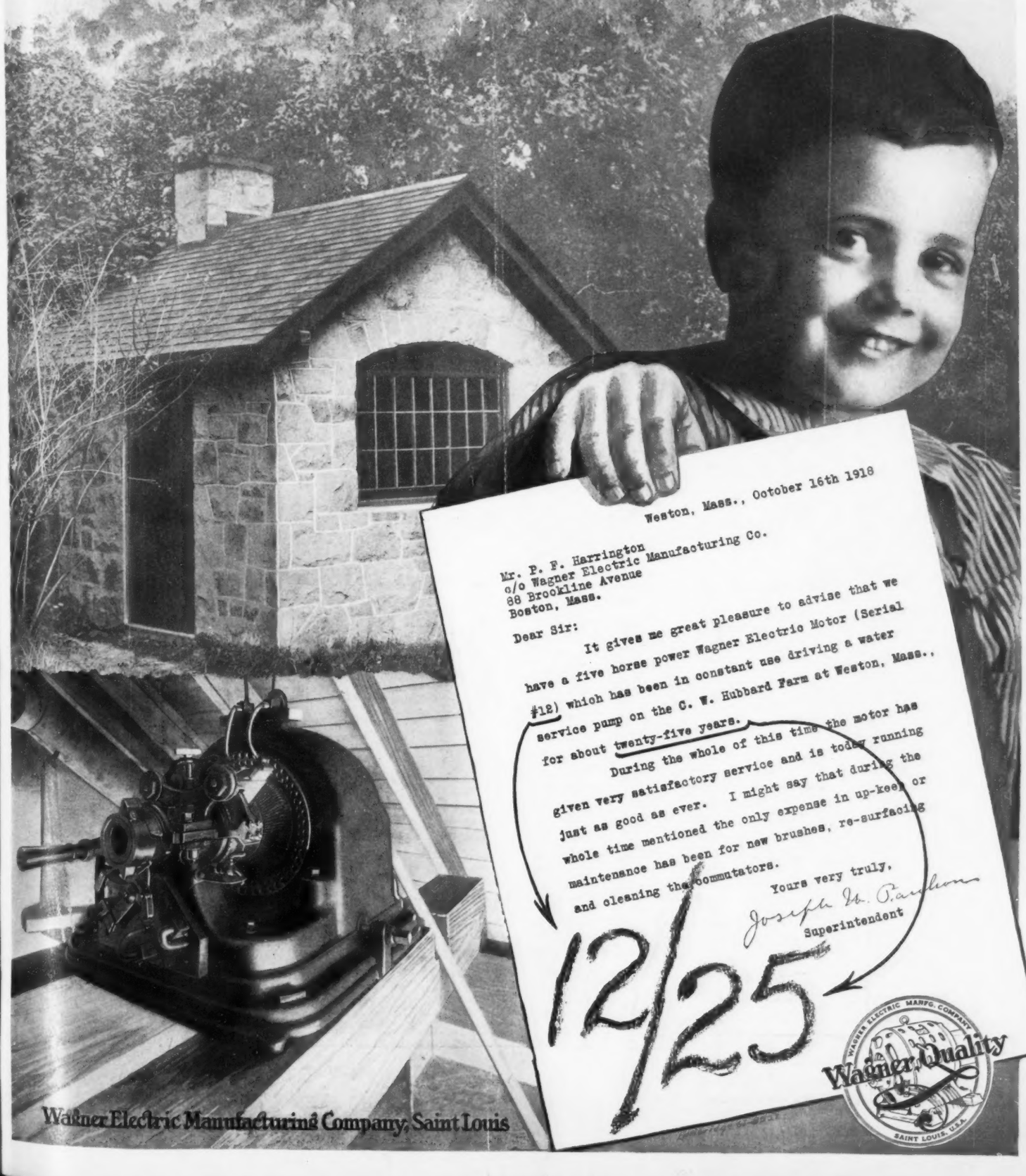
Weston, Mass., October 16th 1918
Mr. P. F. Harrington
c/o Wagner Electric Manufacturing Co.
88 Brookline Avenue
Boston, Mass.
Dear Sir:
It gives me great pleasure to advise that we have a five horse power Wagner Electric Motor (Serial #12) which has been in constant use driving a water service pump on the C. W. Hubbard Farm at Weston, Mass., for about twenty-five years.
During the whole of this time the motor has given very satisfactory service and is today running just as good as ever. I might say that during the whole time mentioned the only expense in up-keep or maintenance has been for new brushes, re-surfacing and cleaning the commutators.
Yours very truly,
Joseph W. Parkman
Superintendent
12/25
Wagner Quality
WAGNER ELECTRIC MFG. COMPANY
SAINT LOUIS, U.S.A.
Wagner Electric Manufacturing Company, Saint Louis

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 73 — New York, Saturday, February 1, 1919 — *Number* 5

The Pause for Breath

EVERYBODY to-day recognizes that business is holding up, that the wheels of industry are slowing down, and that a vast number of workers, estimated by some in the millions, are temporarily jobless. The causes are plain enough. Government contracts in enormous amounts have been canceled; their place has not been taken by civilian work; what they bring forth has necessarily been cut down, or works have shut up altogether; still more workers are coming in from the demobilizing army, and buyers are waiting for the fall of prices from their present high estate to the more commonplace level of peace. The condition is a perfectly natural one and must inevitably last until some measure of stability is given to international relations by the determinations of the international congress. We are inclined to think, however, that the real seriousness of the situation is somewhat exaggerated. We have just come through not only the greatest war recorded since mankind came upon the earth but the greatest epidemic of all history. The tremendous strain of effort and anxiety has just been relieved, and the world slackens pace a little to catch its breath for the work of finding again the pace that makes for progress.

That many difficult questions have to be settled is perfectly true. We are in a period when artificially exaggerated demands have forced the price of labor to heights from which it will have to sink now that the supports are being withdrawn. The same is true of prices of material, which shot sky-high under the impulse of government demands for instant delivery and of utterly reckless monetary inflation. This house of bubbles is due to collapse, and the hope of society is that it will not do so too suddenly. The matter to which we wish especially to direct attention now is to beware lest too cautious waiting for something to happen may lead to the loss of valuable opportunity. There is a tremendous amount of work to be done in the electrical industries in the next few years—work of rehabilitation and in the resumption of the general growth that has been temporarily checked. Now is the time actively to prepare for meeting these requirements.

The rest of the world shares our troubles. It has lost more than we have in men and industrial material. It has relatively lost less in the artificial rise of prices. Consequently we have no competitive advantages save in those few things granted us by nature, and what is done must be done by directed effort. In short, this is no time to sit down and wait, hoping that more favorable conditions for competition in the world's trade will come before that competition has fairly developed. Such is not going to be the case, for the rest of the world will get on to the job just as rapidly as possible, in fact is already on the move at the very time when too many Americans are waiting for opportunity to be thrust upon them. If all the technical industries would plan for active work and begin on it at once, the steadying effect of this activity would be very marked. As it is, there is danger that our pause for breath may be so prolonged as to be a serious handicap in the next phase of the eternal struggle for the world's business.

A great principle is involved in the springing to arms of the public utility commissions in various states against the telephone toll rate order of the federal government. The right of a state to regulate intrastate rates is averred to be an exercise of police power of paramount stability, and the finding reached by the court of final appeal on this question will be of great significance.

Support for the Company

SOME utility executives have had to revise their theories about what commissions should and should not do. They have learned to appreciate the fact that, irrespective of the merits of any case, a commission can go only a limited distance in a direction contrary to public opinion. The people, who created the commissions, can kill them. With all their vested authority commissions are human, and it is only to be expected that they will keep in mind the fact that their power comes from the people.

When utilities tried to mold public opinion in favor of the commission having jurisdiction over their territory, their efforts met with no great measure of success. Utility propaganda, when recognized as such, usually back-fires. It has even been said that the only way a utility can help a commission is to damn it. This may have the desired effect in some instances where the utility itself is in bad odor with the people, but it is at best a negative boost. What is required is to inform the public by spreading interesting facts and figures. Not until the people absorb enough of such information to make them appreciate the true conditions will the utilities enjoy the popular support they may be entitled to. How to give the public the required education is one of the problems the industry has to solve. Before the utilities start to try to educate the public, however, it behooves them to reach a point of educational saturation among their own employees and employees' families. Sometimes inquiry shows that this class of citizen is only negatively on the side of the

company, and it is found that the reason is that the utility did not encourage its employees to be anything more. Here is a far-reaching agency for promulgating utility doctrine if the companies will utilize it. It will require tact and energy for the central stations to get full support from their employees. They can give the employees enough facts and figures to permit them to talk interestingly and intelligently about the company's business, but the results should justify the trouble and expense many times over.

A customer told a meter reader that the increase in rates which had just been put into effect was to pay interest on watered stock. As a matter of fact the company was not earning a fair return on the actual money invested. That meter reader was in an excellent position to correct an erroneous idea, whereas he did not know but that the customer was right. How can such employees be expected to support their company effectively in any controversy when they know nothing of the facts involved? These employees exercise a latent influence on public opinion which the utilities can, if they will, turn into a great dynamic force.

Intensive illumination by floodlamps should not lapse into utter disuse with the close of the war. In the advertising and industrial fields there are wonderful opportunities for ingenious applications of this kind which spell long-hour revenue for the central station, with a service graduated to meet an almost infinite variety of conditions. Do not overlook the low-wattage reflector lamp burned all night and every night as an income producer.

Attracting New Industries

ONE of the initial steps in a campaign for attracting new industries, suggested by the discussion of L. W. Alwyn-Schmidt in this issue, is a survey of the economic possibilities of the district. The war has not passed over the United States without causing great changes in the industrial situation. New industries have sprung up as a result of the interruption of foreign commerce, and many of them are here to stay. Other changes in community conditions make it desirable for the central station to have as thorough a knowledge as possible of the status of industries in its community, and a careful survey will reveal many fields for intensive effort.

In such a survey one may study to see what class of factories the neighborhood is best adapted to hold. Much factory building has been done in haphazard fashion without thorough consideration of the various factors which make for success or failure. Questions like the following will arise: Are there sufficient well-situated factory sites? Is there a prospect of sufficient labor or will it be possible to house newly arriving labor at reasonable rents? Which raw materials are found locally and which can be obtained easily? What facilities exist to help the sale and distribution of manufactured products? What are the prospects for the introduction of new industries which will help those already established and will tend to draw still others? What improvements will be necessary for the purpose of attracting new industries?

Obstacles to Interconnection

THE merits of power-plant and transmission-system interconnections are now pretty well established as a general proposition. The war has accelerated consideration of such possibilities in many communities where shortages in fuel and in generating capacity have retarded the munitions program. Yet if peace were already declared the economic need would still justify the most careful study of inter-plant and tie-line problems in locations where opportunities remain to bring about savings in investment as related to use and in fuel and labor as related to output. Costs are likely to remain at high levels for some time after the war, and the conservation of all sorts of resources is going to be a reconstruction policy of great importance. As one means of realizing broad economies without cutting into the quality of service, interconnection is destined to be a live subject for engineering consideration for a long while to come.

It is pertinent to inquire at this time into the reasons why some clearly desirable interconnection projects are not pushed to completion. Passing by those projects which have been realized to the benefit of many producers and consumers of electrical energy—and these projects are not few—one finds now and then a well-conceived program which makes a good start, receives a fair meed of publicity among engineers, reaches the committee stage, and then slows down and stops. What is the cause of this? Two chief reasons may be cited for the failure of interconnection plans to advance as rapidly as seems justified. The first is the difficulty of raising the necessary funds and the second is the failure of a wide circle of interests outside the immediate engineering field to realize the benefits to be derived from the right kind of coöperation.

The development of a community-broad or even state-wide sentiment in favor of an interconnection plan based upon sound engineering requires that the advantages and safeguards of such a plan be very plainly set forth for the understanding of the public and its representatives. This is no less important than winning the consent of the power-plant and distributing-system owners or operators concerned. It must be made exceedingly clear that the proposed tie-in is not an absorption plan disguised by a cloak of good intentions. Where consolidations are proposed the only safe way is to come out with the facts at once. If the interests associated in the interconnection are to remain separate, it is a great mistake not to emphasize this in the public discussion of the project. The smaller plants, and municipal plants in particular, often look with suspicion upon investigations of their possible relations to a tie-line project, even in cases where the profit of all parties concerned is the only goal of the promoters.

Instances have occurred where engineers seeking interconnection data have been refused admittance to plants through a misunderstanding of the real object of their work. Local politics is sometimes an obstacle which must be overcome by publicity and enthusiastic advocacy of the legitimate project by men competent to set forth the facts. Working out the scheme of coöperative investment and coöperative profit-sharing may take time, but it certainly is within the capabilities of the engineer as a business man and technical expert.

Electrochemical Engineering

SINCE the beginning of the war there has been no more startling progress made in any particular field of industrial effort than in the various branches of applied chemistry, and particularly in those which are closely related to the work of the electrical engineer. In numerous paths of endeavor for the country's good the work of the chemist has been preëminently great, often in ways not yet disclosed to the public, and in no small measure have these advances been dependent on the resources of electrochemistry, the profoundly interesting border land between two great branches of engineering. In electrometallurgy, the fixation of nitrogen and the building up and purification of products new and old the electrical engineer and the chemical engineer have joined hands to force their way onward. Both in theory and in practice their activities overlap, for to-day the roots of chemical reaction are believed to have a common basis with electrical forces and many of the mysterious actions in one field overlap those in the other. It therefore behooves both chemists and electrical engineers to pay closer attention to their common inheritance than has ever been done before.

Electrical engineering is far more than the mere knowledge of how to transmit power or intelligence. Chemical engineering reaches much deeper than observed chemical reactions. The two when properly developed represent the applied science of which physical chemistry serves as the theoretical basis, but physical chemistry lies outside the ordinary fields of both chemistry and physics as customarily taught. For years it was the mysterious limbo between two sciences; now, when we discuss both chemical and physical phenomena in terms of electrons, it is time to realize that there is coming into existence a correlated applied science, substantially a branch of engineering. The barrier of unexplored mysteries between chemistry and physics is rapidly being broken down and there is going to be a keen demand for those who are able to apply the knowledge gained in this particular line. It is time, we think, for more attention to be devoted to this growing field of activities. Already there have been some meritorious efforts at training men for the particular work here in hand. The trouble lies in the fact that both chemistry and physics, chemical engineering and electrical engineering, have grown so wide in scope and so strenuous in their demands for the student's time that the addition of anything more within a reasonable period of training is practically out of the question.

Is it not time to realize that the student of chemistry who is devoting a considerable portion of his time to studies of quantitative organic analysis and the student of electrical engineering who is spending weary hours over draftsmanship and machine design are merely laying valuable knowledge on the shelf so far as concerns the acquisition of training of the particular sort we are here considering? There is need for a closer union of applied physics and chemistry than has yet been made available to the student on any substantial scale. The chemistry concerned in borderland researches is mostly so-called inorganic chemistry. The electrical engineering deals with ions and electrons instead of dynamos and transformers. The student who approaches the new field either from the chemical or the electrical side alone finds himself with a very one-sided knowledge of the necessary facts. A course in electrochemistry or chemical physics tells only half the story, perhaps much less than half. We believe, therefore, that it will be well worth while for our educational institutions to face the fact that theoretical and practical knowledge in a very important line of work ought to be made possible to the student without his attempting to acquire the simultaneous mystery of the whole of two sciences either of which is too serious a task for the time allotted to student life.

Let us welcome the boys home electrically and put every cross-roads village with central-station service on the luminous map. Why shouldn't every town have an electrical name-plate facing the railroad with appropriate wording in letters of light to serve as a continuous hospitality committee to travelers in general as well as to the lads in khaki and navy blue?

The Use of Chain Grates

THE notes by T. A. Marsh in this issue upon the characteristics of chain-grate working are closely in line with several papers which we have recently published dealing with the improvement of the conditions of combustion. As our readers know, the chain grate is in very large use, having worked its way into popularity after the gradual course of improvement which Mr. Marsh indicates. With a properly designed chain grate uniform combustion over the grate area can be attained together with high efficiency of operation. From the data here given it becomes evident that even at, and sometimes especially at, low boiler ratings this type of stoker does excellent service. Perhaps the most important factor which Mr. Marsh brings to the front is the very one which seems just now in line to be fully appreciated, the great value of adequate furnace space, particularly in burning rather poor fuel. Ordinarily boilers are set with far too small combustion space, especially when the rate of fuel consumption must be pushed hard to carry the plant over the peak. In fact, from the figures which Mr. Marsh here gives the combustion space is commonly less than a quarter of that desirable for economical burning of fuel.

European practice has been much sounder in this respect, working toward maximum efficiency in combustion at a more moderate rate with respect to the grate area. There probably has been too much effort here to lower the initial expense of the furnace equipment at the cost of less complete utilization of the fuel. It is the old story of penny-wise economy, for the loss of 5 or 10 per cent of fuel value means an annual expense to avert which a considerable increase in cost of the boiler settings would be well worth the while. In burning fuel of below the average quality the losses from insufficient furnace volume increase in severity, and indeed skimping in this particular sometimes interferes seriously with the use of fuels which would otherwise be economically desirable. These facts have been repeatedly rubbed in in recent discussions of combustion, and we hope that they will in time be more fully appreciated than they have been in the past. There is room for much reform in the efficient production of steam, and, as we have repeatedly pointed out, right here lies the main secret of high plant efficiency.

Long-Line Phenomena and Vector Locus Diagrams

Long-Line Transmission Problems May Be Readily Solved by the Use of Rigorous Hyperbolic Equations of Very Simple Form—An Analysis of Equations of This Form with Vector Diagrams for Graphical Interpretation

BY EDY VELANDER
Massachusetts Institute of Technology

IT IS a well-known fact that the distributed capacitance of alternating-current lines gives rise to all sorts of peculiar phenomena as regards voltage and current distribution. Numerical investigations on long transmission lines and cables occur in every-day engineering. The theory has reached the textbook stage, and the expressions for the steady state, in the excellent simplicity of the Kennelly hyperbolic forms,

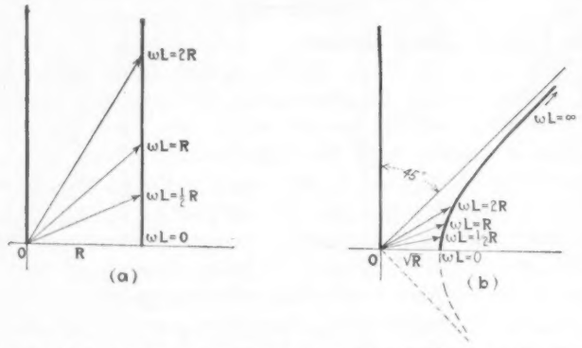


FIG. 1—(*a*) LOCUS OF VERTICAL IMPEDANCE Z, FOR CONSTANT RESISTANCE; (*b*) CURVE TRACED BY $\sqrt{Z}$ FOR CONSTANT RESISTANCE.

are so compact that the whole codex of rigid formulas can be written down on a thumbnail. In spite of all this the thorough understanding of the long-line phenomena is mostly looked upon as a prerogative of the few.

The responsibility lies heavily on the complex hyperbolic functions. The practical engineering mind always looks for some mental picture of the investigated phenomena, some graphical representation of the equations. The difficulty in visualizing the hyperbolic functions has therefore necessarily resulted in a certain suspiciousness vis-à-vis everything "hyperbolic," and the theory has been less appreciated.

Unfortunately, in earlier efforts to visualize the long-line phenomena the ordinary kind of Cartesian two-dimensional diagram was often used. Voltages and currents on a line, however, just as in an ordinary alternating-current circuit, are most clearly represented by plane vectors. The variation of a vector is shown by the trace of its endpoint. This trace in the complex plane, or vector locus, in the consideration of alternating-current quantities takes the place of the ordinary, real curve in a Cartesian diagram, which is sufficient in a direct-current case. The abscissa, or independent variable, in the vector locus diagram is conveniently plotted as a line coördinate along the locus.

The characteristics of a three-phase induction motor are most easily discussed by means of a Heyland vector locus diagram. Correspondingly for the long-line phenomena, as soon as the vector locus diagram is employed in the discussion, the apparent difficulty in getting a graphical representation of the theory fades away; all the fundamental phenomena can be interpreted in an exceedingly simple way, without any approximations whatsoever, and without the lack of generality inherent in the numerical-example way of illustrating the formulas.

THE ELECTRIC LENGTH OF A LINE

A homogeneous electric line is physically defined by its length, D, and the four line constants, r, l, c and g, denoting the resistance, inductance, capacitance and leakance per unit length. The behavior of the line depends furthermore upon the frequency of the impressed voltage, f cycles per second, or its angular velocity, $\omega = 2\pi f$. In the vector notation we may combine these six parameters and get two complex quantities, together completely describing the line. These quantities may be called the virtual impedance of the line, $Z = R + j\omega L$, and the virtual admittance of the line, $Y = G + j\omega C$. R stands here for Dr, the total resistance of the line conductor; correspondingly $L = Dl$, and so on.

In the "hyperbolic theory" the line is said to subtend a certain complex hyperbolic angle, $\theta = \sqrt{ZY}$. The quantity θ represents in a sense the length of the line. This "electrical" or "hyperbolic" length is not measured in miles or kilometers, but in complex hyperbolic radians, and is therefore a numerical vector. It tells, however, to what extent the line is to be regarded as a "long line"; *i.e.*, how much distortion in the distribution of voltage and current is to be expected as an effect of the capacitance and leakance of the line.

To get a conception of the quantity θ, consider its two factors, $\sqrt{Z}$ and $\sqrt{Y}$. The virtual impedance, Z, or $R + j\omega L$, is shown on Fig. 1a. For a very small

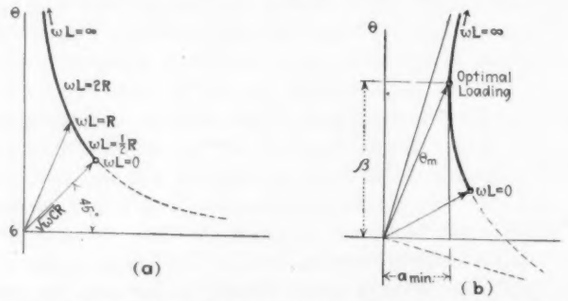


FIG. 2—(*a*) LOCUS OF Θ, ELECTRICAL LENGTH OF LINE, FOR R, C, AND ω CONSTANT, L INCREASING FROM ZERO TO INFINITY; (*b*) SAME AS (*a*) BUT APPLIED TO LOADED LEAKY CABLE.

reactance ωL, Z will be a vector of length R along the real axis. When the reactance is increased the vector Z will vary along a vertical line. In computing $\sqrt{Z}$ we have to recall the rule that the square root of a complex quantity is another vector with half the slope

and with a size equal to the square root of the size of the original vector. The largest slope our impedance Z can attain is 90 deg. $\sqrt{Z}$ will therefore tend toward a 45-deg. slope. The real vector R will simply be reduced to $\sqrt{R}$, and the locus of $\sqrt{Z}$ will be one-half branch of a hyperbola with the first median line for an asymptote (Fig. 1b).

For ordinary efficient lines the leakance G is very small. The admittance Y will therefore have very nearly 90-deg. slope, and its square root will be a 45-deg. quantity, $\sqrt{Y} = \sqrt{\omega C}/45°$. Let us now consider the product of $\sqrt{Y}$ into $\sqrt{Z}$, the latter being represented by its locus (Fig. 1b). The vector rule is: Multiply sizes, add angles. In the new plot our hyperbola will simply be tipped over 45 deg. and reproduced to a new scale, in proportion $\sqrt{\omega C} \div 1$. Fig. 2a shows the locus of $\sqrt{ZY}$, or the hyperbolic length θ of a leakage-free line whose inductance is increased from zero to infinity.

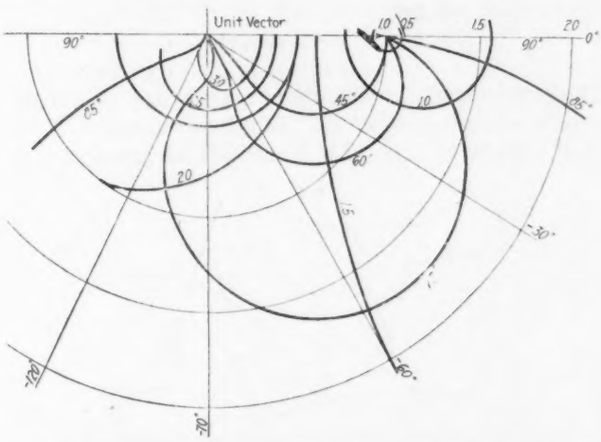


FIG. 4—VARIATION OF VECTOR (TANH Θ)/Θ WITH SIZE AND SLOPE OF Θ. SIZE Θ = 0.5, 1.0, 1.5, 2.0, 2.5, 3.0; SLOPE Θ = 45°, 60°, 75°, 85°, 90°

The plot shows that the slope of θ always is less than 90 deg. In a leakage-free line it will always be more than 45 deg., reaching this limit when the inductance is negligible; *i.e.*, for a cable. For an aërial line, where the inductance is comparatively very large, θ will have a slope of 80-85 deg.

THE LOADED TELEPHONE CABLE

The quantity θ is sometimes called the propagation constant and denoted as $\alpha + j\beta$. In a very long line—for instance, a long telephone cable—the current and voltage fall off as $e^{-\theta}$; *i.e.*, the received current is only $e^{-\alpha}$ of the sending-end current (lagging β circ. rad. behind it). The limiting length of a telephone cable is therefore determined exclusively by α, the real part of our vector θ.

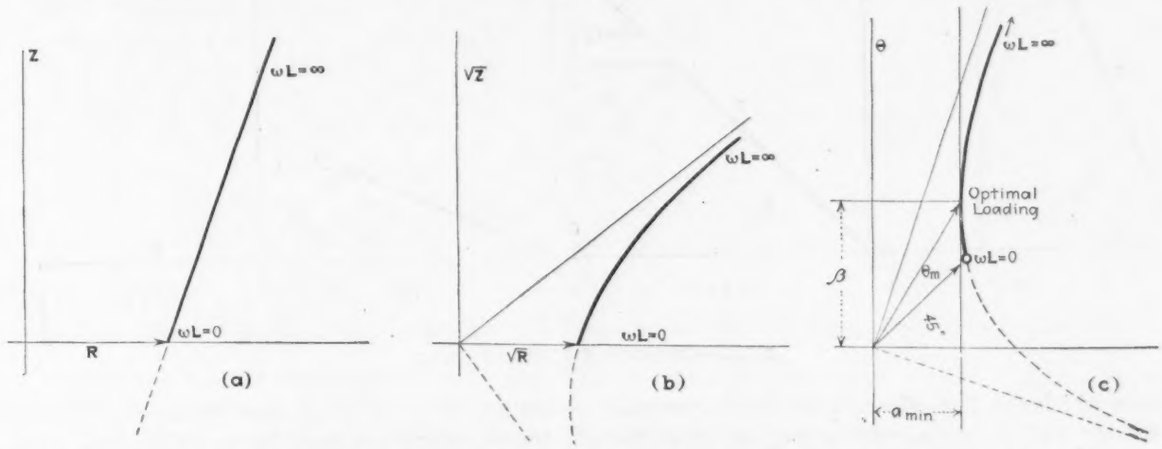


FIG. 3—(*a*) VIRTUAL IMPEDANCE WITH INCREASING NUMBER OF LOADING COILS OF FIXED TIME CONSTANT; (*b*) TRACE OF $\sqrt{Z}$; (*c*) SHOWING EFFECT OF RESISTANCE IN LOADING COILS

Now, from a consideration of Fig 2a, it is clear that if by some means we could increase the inductance of the cable, α could be decreased toward zero, and it would then be possible to cover very much larger areas with the same kind of cable and apparatus. According to Pupin's method of "loading" the cable, inductance is added by means of inductance coils, connected in series in the cable, sufficiently small and not spaced too far apart to affect the homogeneity of the line.

When the amount of loading increases θ will travel along the locus of Fig. 2a. In practice, however, there are certain limitations to the method. If there is any appreciable amount of leakage in the cable, $\sqrt{Y}$ will have a slope of less than 45 deg. This means that the whole hyperbola will be turned back just as many degrees as $\sqrt{Y}$ is short of 45 deg. Fig. 2b shows the new conditions, which are far different. A certain minimum value of α exists here, below which it is impossible to go. To this $\alpha_{min.}$ corresponds an optimal amount of loading, so that an additional increase of inductance will make the line less efficient for transmission purposes.

Even if the leakance were negligible, the unavoidable resistance of the loading coils would put a limit to the improvement by loading. Suppose, for instance, that the coils could be made of a certain fixed time constant only. With increasing number of coils the total virtual impedance of the cable would vary as in Fig. 3a, starting from the pure resistance value R for unloaded cable. The square root of Z would have for its locus a hyperbola as before, but the asymptote would now make less

than 45 deg. with the real axis. The locus for $\sqrt{ZY}$ (Fig. 3c) has therefore in such a case the same characteristics as for the leaky cable.

THE SHORT-CIRCUITED LINE

Owing to effects of capacity and leakance, the virtual impedance Z can never be directly measured. The impedance which the line offers at the generator end, when the far end is short-circuited, may be called the apparent impedance and denoted Z_s. From the hyperbolic theory we take the well-known formula

$$Z_s = z_0 \tanh \theta.$$

Here z_0 is the "surge impedance" of the line, or $\sqrt{Z/Y}$. This formula may be rewritten in following form:

$$Z_s = Z \ (\tanh \theta)/\theta,$$

and suggests then that the influence of the capacity of the line may be conceived as a disturbance taken care of by a correction factor $(\tanh \theta)/\theta$. This function, of course, is a vector. It is shown in the graph of Fig. 4 for different sizes of θ, and for several slopes between the practical limits 45 deg. and 90 deg.

To obtain the apparent short-circuit impedance of a line we have only to pick out of this graph the vector correction and apply this to the virtual no-capacity impedance of the line.

In the graph the 45-deg. curve applying to a cable has an interesting physical significance as it stands. For a cable the virtual impedance is simply R ohms, real, and the size of θ is $\sqrt{R\omega C}$. To a certain scale the 45-deg. line of Fig. 4, therefore, represents the apparent impedance of any short-circuited cable, the frequency being varied from zero to infinity.

CAPACITY EFFECTS IN COILS AT HIGH FREQUENCY

Any kind of a coil has a certain distributed capacitance to ground. There are also a capacity between windings and an internal mutual inductance which complicate the phenomena. As a first approximation, however, the hyperbolic theory can be applied as giving an estimation of the effect upon the apparent impedance of the coil which the capacity to ground may have.

The simplest case is the bifilar coil, which can be looked upon as a short-circuited cable. The 45-deg. curve in Fig. 4 shows therefore directly what errors may be expected in using a bifilar resistance standard at very high frequency. Fortunately, the apparent change in resistance is very small, even at rather high frequency, but the phase angle of the coil will rapidly grow negative. Even at an apparent phase angle of —5 deg., however, the change in resistance is only —0.06 per cent.

In the discussion of the inductive coil grounded at one end we will go still further in simplification. Developing $\tanh \theta/\theta$ in a power series and neglecting higher terms, we get

$$\tanh \theta/\theta = 1 - \tfrac{1}{3}\theta^2 + \\ = 1 - \tfrac{1}{3}ZY \text{ (approximately)}.$$

The capacity effects will, therefore, appear as a little disturbance vector, $-\tfrac{1}{3}ZY.Z$, added to the vector Z of virtual impedance. In Fig. 5 the virtual impedance Z and the disturbance vector are drawn for different cases, corresponding to different slopes of Z (leakance neglected).

In a highly inductive coil resistance as well as in-

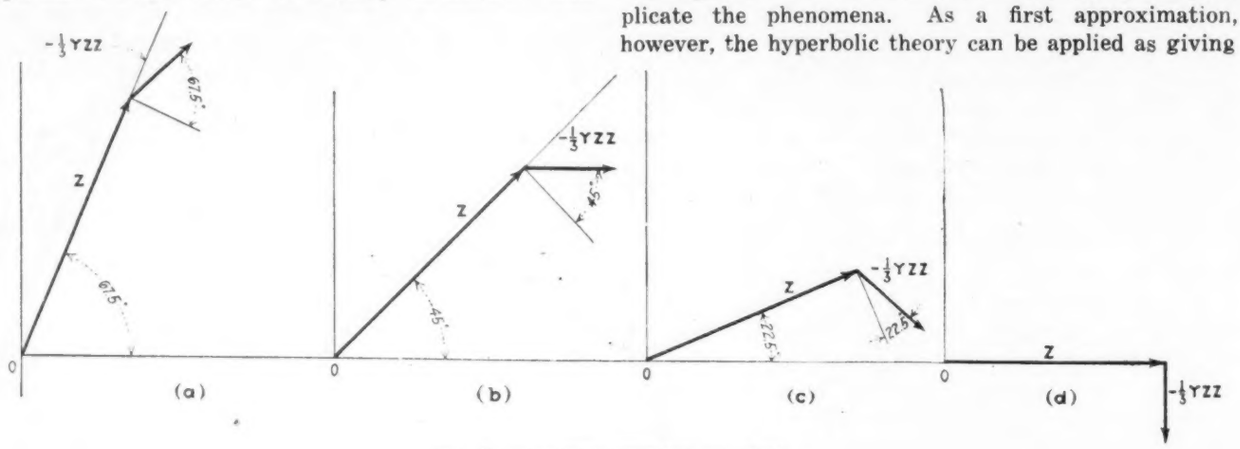


FIG. 5—CAPACITY EFFECTS IN COILS

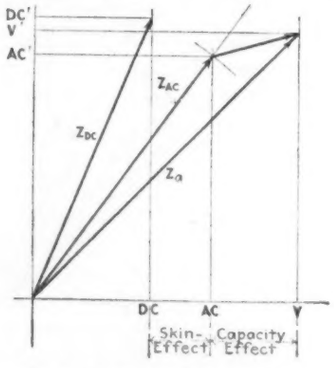


FIG. 6—SKIN EFFECT AND CAPACITY EFFECT IN COILS

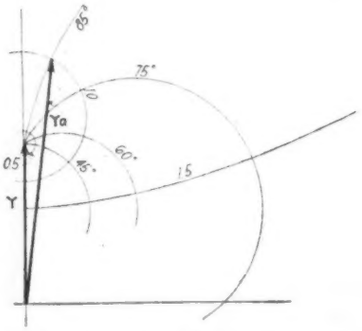


FIG. 7—APPARENT ADMITTANCE OF AN OPEN LINE—$Y_a = Y \ (\tanh \theta)/\theta$

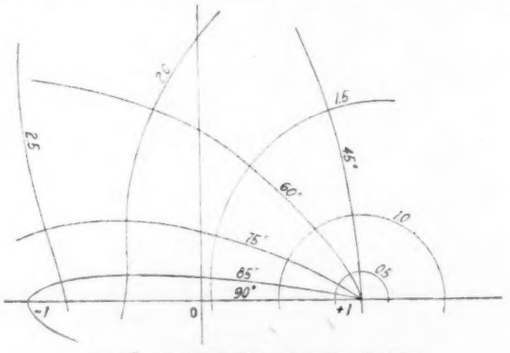


FIG. 8—VARIATION OF THE VECTOR COSH θ

ductance appears increased. In the intermediate case of $R = \omega L$ the inductance is unchanged, but the resistance is increased. For the coil with very high resistance the change in apparent resistance is less appreciable, but the apparent inductance is greatly diminished. Fig. 5d represents the conditions of the bifilar coil.

This simple discussion gives an interesting interpretation of the errors due to distributed capacity which often obscure the results of high-frequency measurements on skin effect.

In Fig. 6 suppose *O-DC* to be the direct current resistance of a certain sample coil. *O-DC'* represents the reactance of the coil, computed from its low-frequency inductance. The skin effect tends to increase the resistance and decrease the inductance of the coil. Therefore, the virtual impedance of the coil at high frequency may have the components *O-AC* and *O-AC'*. According to Fig. 5a, we obtain the apparent impedance Z_a which is the only thing that can be measured. The effect of capacity is in this case to exaggerate the skin-effect resistance increase and to mask the decrease in inductance. Such errors due to capacity often are overlooked, but will probably account for many discrepancies between theory and observation.

OPEN LINE

To obtain the apparent admittance of an open-circuit line exactly the same correction should be applied to its virtual admittance:

$$Y_a = Y(\tanh \theta)/\theta$$

To show clearly the effect upon the admittance of a line due to the distributed impedance the tanh θ/θ plot is given once more in Fig. 7, turned over 90 deg. so that the unit vector coincides with the admittance of a pure condenser. This graph gives a good idea of the charging current of an unloaded transmission line. Here Y represents the virtual admittance (no leakage) of the line, as computed from its capacity per unit length. The real generator-end admittance will lie somewhere between the lines for 75 deg. and 85 deg. The line takes, therefore, a larger no-load current than would be expected from its capacity, and it takes even at no load a certain in-phase current, thus constantly wasting power.

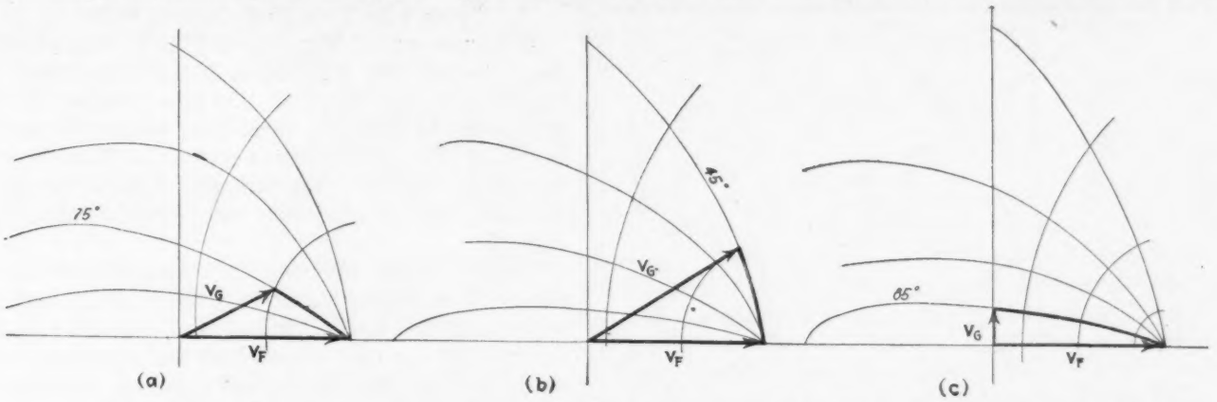


FIG. 9—VOLTAGE DIAGRAMS FOR AN OPEN LINE: (*a*) FERRANTI EFFECT, (*b*) CABLE, (*c*) QUARTER-WAVE LINE

For the voltage on an open line the following equation holds: $V_g = V_f \cosh \theta$, where V_g is generator voltage and V_f the voltage at the free end. From the point of view of our earlier considerations also, cosh θ is evidently to be looked upon as a vector correction factor. As a matter of fact, the graph of cosh θ (Fig. 8) gives a good justification of this notion. For a short line, cosh θ practically coincides with unity, but when the size of θ reaches 1 the deviation is already appreciable.

Figs. 9a, 9b and 9c illustrate the conditions for an aërial transmission line, a cable and a "quarter-wave line" of small resistance; for instance, a radio antenna. The first figure shows that the voltage at the free end of an aërial transmission line always is larger than the generator voltage, due to the well-known Ferranti effect. Fig. 9b shows that such a voltage rise can never occur in a cabled line, a large slope of θ being essential for its existence. The last case shows line resonance

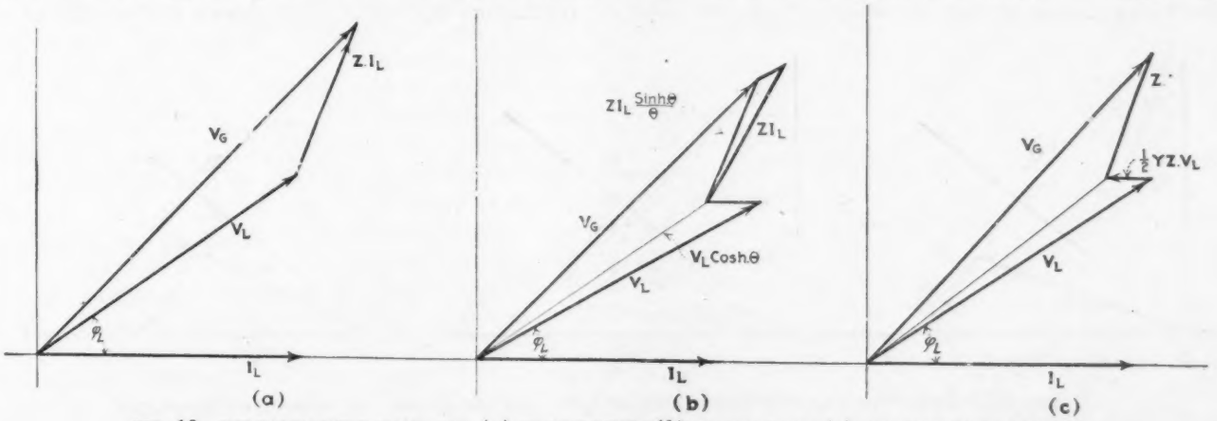


FIG. 10—VOLTAGE REGULATION FOR (*a*) SHORT LINE, (*b*) LONG LINE, (*c*) APPROXIMATE SCHEME.

in the fundamental mode of oscillation. A relatively small generator voltage is sufficient to maintain a very high voltage at the end of the antenna. This resonance phenomenon comes forth as nothing but an exaggeration of the Ferranti voltage rise.

THE TWO TRANSMISSION PROBLEMS

Among the characteristics of a power-transmission line two quantities are considered especially important,

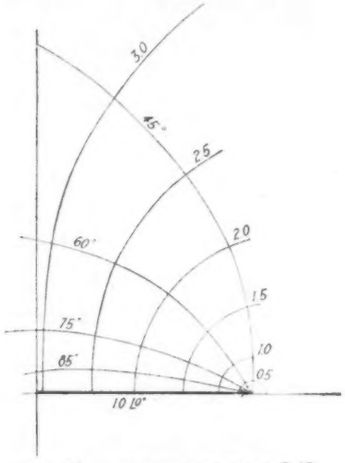


FIG. 11—THE VECTOR SINH θ/θ

namely, the voltage regulation, or the generator voltage in per cent of the voltage at the load, and the current regulation, or the generator current in per cent of the load current.

In the simpler case of a short line, where no appreciable capacity effects are to be expected, the generator voltage is obtained simply by vectorially adding the guaranteed load voltage V_l and the vector drop ZI_l (Fig. 10a).

If the line is electrically long, we have to take resort to the exact formula of the hyperbolic theory. In accordance with our earlier work we will try to get this formula in the same form as in the simpler case, and write therefore:

$$V_g = V_l \cosh \theta + ZI_l \ (\sinh \theta)/\theta.$$

This expression suggests that the long-line problem can be solved in just as simple manner as that for a short line if only certain correction factors are applied upon V_l and ZI_l before adding. Besides our well-known correction factor cosh θ, another hyperbolic function of similar nature appears, sinh θ/θ, which is plotted in Fig. 11.

The exact graphical addition leading to the voltage regulation is shown in Fig. 10b. In accurate work the addition should be made by computation and not graphically, and the correction vectors should then be taken from a table of hyperbolic functions.

For short lines, and when considerations of accuracy are less important, an approximate scheme may easily be derived by using a series-expansion for cosh θ, dropping all terms except the first one:

$$\cosh \theta = 1 + \tfrac{1}{2}YZ \text{ (approximately).}$$

A comparison of Fig. 8 and Fig. 11 will show that the function cosh θ diverges from unity much more rapidly than does sinh θ/θ. The latter correction, being applied to the relatively small drop voltage, is therefore in reality of a lesser order of magnitude than the cosh θ correction. In our approximate method we should therefore leave it altogether out of consideration, as in Fig. 10c.

When a better accuracy is required, however, the necessary hyperbolic functions should always be taken out of available tables. It has been suggested that the computation for each occasion of the series expansions would be easier for the average engineer. No engineer with ordinary common sense would go all over the series computation to arrive at the value of, say, cos 25 deg. For similar reasons the vector series addition leading to a complex hyperbolic cosine or sine should be looked upon as an instructive exercise for the student, but nothing beyond that.

The computation of the current regulation of a long line may be referred to the solving of a short-line problem in much the same way as the computation of voltage regulation. The simpler physical scheme is in this case a short high-tension line, where the drop can be neglected. The voltage is then V_l all over the line, and the charging current will be YV_l. The generator current will be the vector sum

$$I_g = I_l + YV_l.$$

(See Fig. 12a.) In the exact form the formula for a long line is

$$I_g = I_l \cosh \theta + YV_l(\sinh \theta)/\theta.$$

The formula shows the complete reciprocity of voltage and current. Exactly the same considerations as for voltage hold here. The rigid diagram for a long-line is shown in Fig. 12b, and an approximative scheme, corresponding to Fig. 10c is drawn in Fig. 12c.

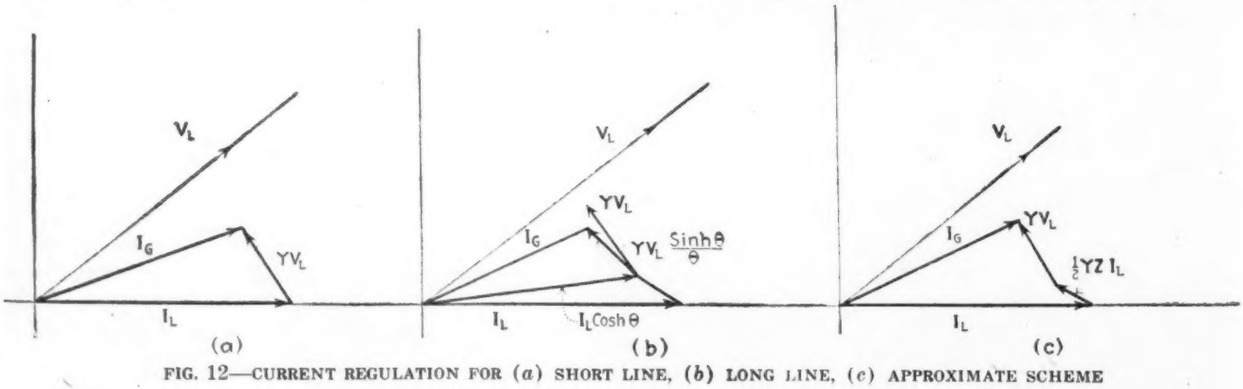


FIG. 12—CURRENT REGULATION FOR (*a*) SHORT LINE, (*b*) LONG LINE, (*c*) APPROXIMATE SCHEME

Similar devices can be used to refer every kind of investigation on regulation, constant-voltage transmission, or any other characteristics of a long power-transmission line, back to the simple corresponding problem regarding a short line.

CHAIN GRATES AND THEIR GENERAL CHARACTERISTICS

They Have Caused Changes in Furnace Design Which Greatly Improve Efficiency of Boiler Unit Especially at Light Load

BY T. A. MARSH
Chief Engineer of Green Engineering Company

SIMPLICITY, ease of operation and high efficiency over a wide range of operating conditions have been responsible for the installation of a large number of chain grates. With modern chain-grate furnaces, 14 per cent CO_2 may be carried during regular operating periods, and the maximum furnace efficiency corresponds with the maximum CO_2 up to the point where CO is developed. Modern practice has thus increased the combined efficiency of the boiler unit approximately 10 per cent on the average, largely by an agency separate from the stoker itself, namely, waterback and ledge plates to prevent excess air; but this also is part of modern chain-grate design and construction. In the United States alone several millions of boiler-horsepower are served by this type of stoker, but, in spite of the number of installations, comparatively little has been written on the characteristics of the chain grate and recent developments in this stoker and the furnace serving it.

In early chain-grate practice it was impossible to keep the fuel bed at the rear of the stoker as dense as at the front. This was obviously wrong as large volumes of excess air infiltrated through the thin fuel bed at the rear. The introduction of the waterback improved operating conditions. When properly set it permits compression of the fuel bed and makes it possible to obtain the desired density at the rear of the grate. To a certain extent this is under the control of the operator. Excess air around the rear of the grate is eliminated and special plates shut it off at the sides, so that 13 to 16 per cent of CO_2 is not unusual. Waterbacks also help in retaining the coke and in reducing the combustible in the refuse to a lower percentage than was possible with the early installations that did not have this equipment.

In some quarters the opinion has prevailed that boiler operation appreciably below normal rating means low efficiency. The basis for this opinion probably is due to experience in hand-fired practice, where it is difficult to carry a thin light fire and keep it free from holes and excess air. It perhaps is not generally appreciated that chain grates do carry light loads efficiently. In fact, with furnaces of limited design, the economy is better than can be obtained from these same limited furnaces at the higher rates of combustion.

Ratings below normal have not claimed the interest of combustion engineers, owing to the desire to obtain high overloads, so that test data for the most part relate to operation above rating. If a stoker cannot be operated efficiently at low ratings, it is a serious drawback where light loads occur for extended periods. To show what may be accomplished in this direction the accompanying table is presented. It gives results from one type of chain grate under several types of boilers.

It is not sufficient to remark that the chain grate will develop high efficiencies at low ratings. The cause is the interesting item. For the burning of high volatile coals most furnaces have been designed with insufficient volume for the combustion of the gases. Usually the furnace has from one-fifth to one-tenth of the volume needed. The average chain-grate installation in the United States has been designed and provided with draft to burn 25 lb. to 40 lb. of coal per square foot (122 kg. to 195 kg. per sq.m.) of grate area per hour,

CHAIN-GRATE EFFICIENCIES AT LOW RATING

Type of Boiler	Coal Burned per Sq. Ft. per Hr., Lb.	Furnace Draft, In. of Water	Per Cent. Rating	Combined Efficiency
Edge Moor	16.88	0.16	113	81.9
Stirling	16.50	0.09	107	78.3
Stirling	14.40	0.10	91	77.4
B. & W.	7.90	0.03	57	78.4
Geary	20.00	0.18	105	77.5

with a furnace volume capable of obtaining complete combustion from only about 10 lb. (41 kg.) of coal.

In Europe, where there are a great many chain-grate installations, the practice follows the idea of large grate area and low combustion rates. Normal loads are carried with combustion rates of from 10 lb. to 15 lb. per square foot (49 kg. to 73 kg. per sq.m.) of grate area per hour, while peaks are carried with combustion rates of two to three times this amount in this country. Naturally the efficiency of combustion, or true furnace efficiency, is superior to that obtained over a higher range of combustion rates, and since efficient boilers and economizers have been developed also in Europe, there is little wonder that over-all efficiencies are high. Low combustion rates permit complete combustion of the gases in the furnace without the usual 5 to 15 per cent hydrocarbon, or so-called unaccounted for, loss.

SUFFICIENT COMBUSTION SPACE NEEDED

By the same reasoning it is evident that if furnaces are designed with volumes great enough to permit the complete burning of the gases at high ratings, high efficiencies will also be obtained at high ratings. With furnaces having a combustion space of 10 cu.ft. to 24 cu.ft. per square foot (2.15 cu.m. to 7.25 cu.m. per sq.m.) of grate area, chain grates are developing combined efficiencies of from 70 to 80 per cent, which decrease only as the efficiency of heat absorption of the boiler decreases.

In the earlier chain-grate installations it was difficult to obtain as high as 12 per cent CO_2 on account of the thin fuel bed at the rear, and the efficiency was actually higher if lower CO_2 of about 10 per cent was carried. This is direct evidence of insufficient furnace volume.

By providing sufficient combustion space per unit of grate area and guarding against excess at the rear it has thus been possible to increase substantially the efficiency of the boiler unit. Other well-known characteristics of chain grates are continuous ash discharge, minimum clinker, ability to burn low-grade coals and lignites, cleanliness of the grate surface, low labor requirements, and the fact that power for auxiliaries is less than one-half of 1 per cent of that developed. The chain grate covers an important field in combustion service, and it is certain that by a study of the stoker, the furnace and the heat absorber separately there is opportunity for considerable improvement in operating efficiencies.

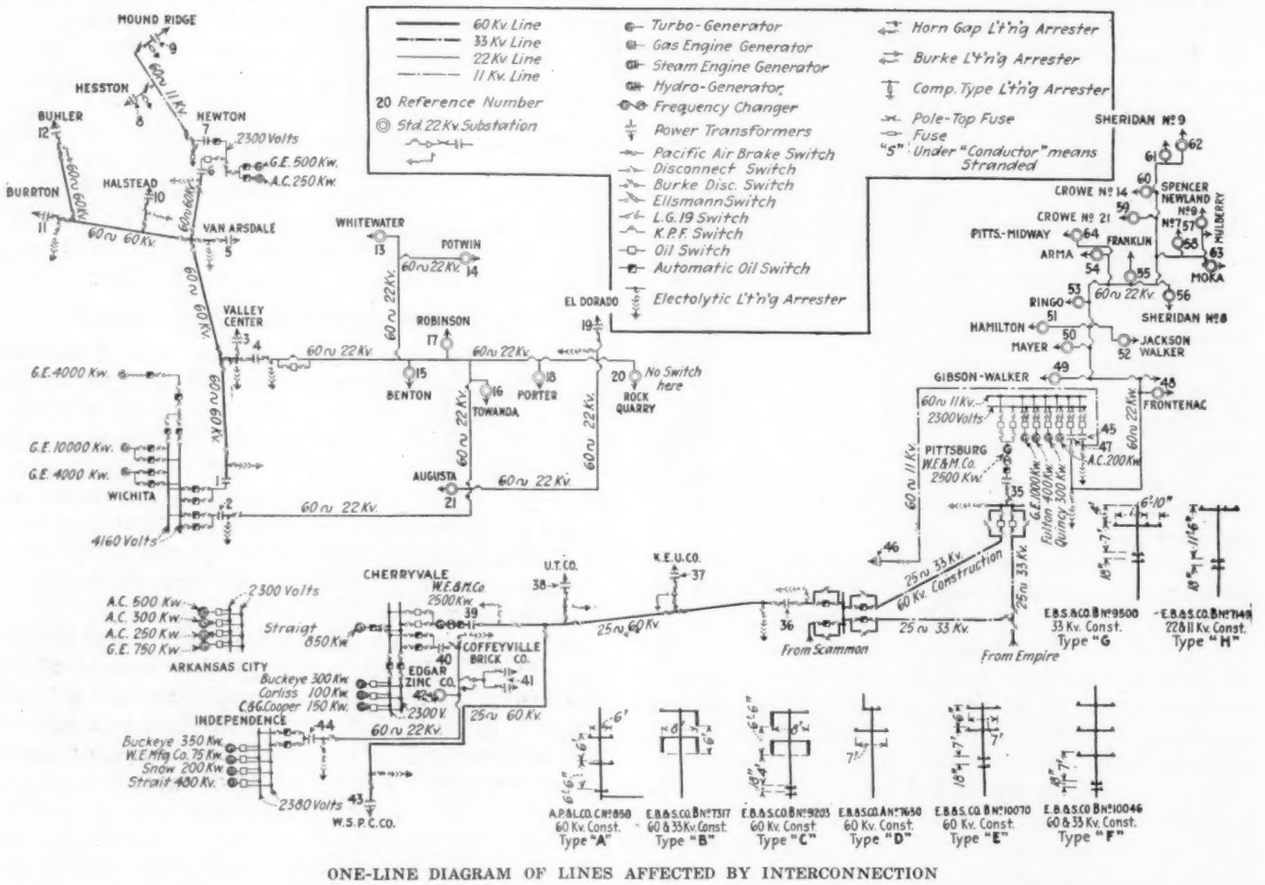
SOUTHWESTERN COMPANIES WILL EXCHANGE POWER

Kansas Gas & Electric Company of Wichita and Empire District Electric Company of Joplin Have Completed Arrangements for Interconnection

CONSTRUCTION has now been completed so that power in amounts up to 10,000 kw. can be exchanged between the Kansas Gas & Electric Company of Wichita, Kan., and the Empire District Electric Company of Joplin, Mo. It is not intended that power in such large quantities will be transmitted from Joplin to Wichita or from Wichita to Joplin, as there is still an open link in the system between Wichita and Independence. The arrangement is made to provide power to that productive section of eastern Kansas which lies between Wichita and Joplin, centering around the towns of Independence, Cherokee, Cherryvale, Coffeyville, Parsons and Pittsburg. The importance of this territory has been emphasized by war conditions, since it is a region which produces large quantities of oil and coal. The extent of the territory between the cities of Wichita and Joplin can be better appreciated when it is understood that the interconnecting system, if laid down in other sections of the country, would cover the territory between New York City and Reading, Pa., or between Montgomery, Ala., and Meridian, Miss., or between San Francisco, Cal., and Fresno, Cal., or between Minneapolis, Minn., and Mason City, Iowa, or between Columbus, Ohio, and Muncie, Ind.

The problem has been further complicated by the fact that the system of the Kansas Gas & Electric Company operates at 60 cycles while that of the Empire District Electric Company operates at 25 cycles. In the carrying out of this plan duplicate lines have been built from the system of the Empire District Electric Company to a switching station at Cherokee and duplicate lines have been built from this switching station to the city of Pittsburg. These duplicate three-phase lines operate at 33,000 volts and 25 cycles. At Cherokee an outdoor substation consisting of three 2000-kva. transformers has been constructed to step up the energy from 33,000 volts to 66,000 volts for transmission at 25 cycles to the cities of Cherryvale, Parsons and Independence. Three frequency-changer installations have been completed, and through these the two systems are synchronized. The frequency-changer installations at Pittsburg and Cherryvale are each rated at 2500 kw., while the one at Parsons is rated at 928 kw. The Cherryvale installation is typical of these substations. It consists of three 770-kva. transformers for stepping the potential down to 2400 volts, at which voltage it is delivered to the frequency changers. Part of the energy from this frequency changer is taken to three 600-kw., 24,000-volt, 60-cycle transformers to be stepped up and transmitted to Independence. A rather unusual feature of these installations is that the equipment used in connection with the frequency changers is all manually operated.

While the equipment installed is sufficient to permit the interchange of 10,000 kw., the contract between the two companies is of the sort known as a waste-power contract, so that it is improbable that this amount will be transferred immediately.



ONE-LINE DIAGRAM OF LINES AFFECTED BY INTERCONNECTION

Notes on Demand Meters

Indicating Demand Meters Are Used for Small Installations, but for Important Industrial Loads Recording or Curve-Drawing Meters Serve Many Purposes—Principles Upon Which Modern Demand Meters Operate

BY H. W. RICHARDSON
General Electric Company

THE increased cost of coal, material and labor has forced upon the central station the necessity for effecting economy as well as increasing rates, particularly to power customers. In the attempt to effect economy there has been an increasing tendency to recognize the justice of the differential rates, which indicates that a measured demand is as essential to-day as the watt-hour basis of charge was years ago. It is the aim of this article to familiarize the reader with various demand meters and their application.

The idea that the cost of energy should be based on a fixed charge, proportional to the investment, as well as a variable charge, proportional to operating expense, is attributed to Hopkinson, and his original paper on the subject is still regarded as a classic.

With the growth of the central-station business it became evident that the maximum demand of some consumers resulted in a far greater burden on the plant than the high energy consumption of others, at good load factor. Thus the differential rates, depending upon the customer's demand, have come into wide use, and it is essential that the principles upon which demand-meter operation depend should be fully understood.

Classification of Demand Meters

There are five classes of demand meters:

(1) Instantaneous demand meters; *e.g.*, indicating ammeters and wattmeters, also curve-drawing ammeters and wattmeters.

(2) Time-lagged demand meters—Wright demand indicator, type "W" watt demand indicator and type "RO" watt-hour demand meters.

(3) Devices limiting the supply of current to a fixed amount of demand—excess indicators, flat-rate controllers and circuit breakers.

(4) Devices which differentiate the kilowatt-hours used with reference to a fixed demand or a fixed period of time; *e.g.*, two rate meters and the excess-demand watt-hour meter.

(5) Interval demand meters. This class is subdivided further into three types: (a) Predetermined time-interval-indicating meters; *e.g.*, fifteen, thirty or sixty minutes without showing when the maximum occurred; M-4 demand meter. (b) Predetermined-time-interval graphic or curve-drawing devices, recording the demand and showing the time it occurred; *e.g.*, type "G" demand meters, printometer, type "RA" demand watt-hour meter. (c) Predetermining-time-interval recording meter, recording equal blocks of energy in given intervals of time.

This gives a total of sixteen different devices, of which six are now no longer manufactured, or at least only in small quantities

Indicating ammeters and wattmeters give the current or power only at the instant they are being read. Curve-drawing instruments give a record of all the variations in the load and the time when they occur. As a rule they are expensive; consequently their application is to power plants and large power consumers, but in such cases their use is highly commendable.

The Wright demand indicator is an ampere-hour device and can be used on either direct or alternating current. It indicates the maximum current that has passed through the indicator since the last time it was set.

There are few two-rate metering devices used at the present time. Instead of a two-rate instrument, two ordinary meters are employed, one recording during the period of the low rate, the other during the time of the high rate. A time switch is used for the purpose of throwing one or the other meter into or out of action at the proper time.

Basis for Energy Charges

The accepted principle of demand devices to-day is to integrate the requirements for energy over a definite length of time, usually fifteen or thirty minutes. In other words, *demand is the average kilowatt-hours integrated over a definite interval of time.* If, then, we measure with a watt-hour meter the energy being

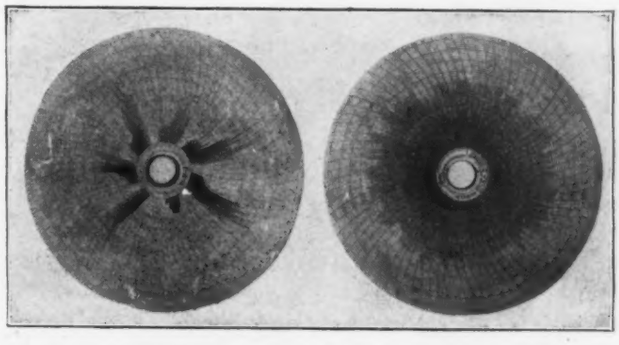


FIG. 1—GRAPHIC DEMAND RECORDS FOR ONE WEEK
At right is shown record of a chemical factory with good load factor. The coal-mine chart, however, has a poor demand characteristic.

used and read the meters, say, every thirty minutes, we secure the demand for each thirty-minute period. The maximum demand will be the largest reading we have secured for a thirty-minute period. If the time is fifteen minutes or sixty minutes, the readings are taken accordingly and the highest is the maximum demand.

The investment of an electric light and power company is for the benefit of all consumers, and the highest

demand of an individual consumer represents the proportion of the equipment or investment reserved for his use. The use, therefore, of a demand meter in conjunction with a watt-hour meter is held to assist the central station to determine a rate to a customer inversely proportional to his load factor. If the various consumers have a high load factor, it tends to increase the load factor on the station, thus reducing the cost of a unit of electricity.

To illustrate the application of a demand meter to a demand rate, let us take specific figures, for example, $1 per kilowatt of demand and 5 cents per kilowatt-hour. Let us further assume two customers with the same maximum demand, 3 kw., the first consuming 300 kw.-hr., the second 600 kw.-hr. The bill for the first one will be 3 kw.-hr. × $1 = $3, plus 300 kw.-hr. at 5 cents = $15, making a total bill of $18. This is at an apparent rate of 6 cents per kilowatt-hour. The bill for the second customer will be 3 kw. × $1 = $3, plus 600 kw.-hr. × 5 cents = $30, making a total of $33. This is an apparent rate of 5½ cents per kilowatt-hour. Thus the second customer pays the lower rate per kilowatt-hour for energy because his consumption is greater in proportion to his demand.

The demand rate tends to arrive fairly close to the value of the service to the various classes of consumers and closely approaches the larger customers' costs when serving themselves, thereby fixing the value as well as the cost of service.

Non-Recording Types Commonly Used

It will be evident that a demand meter of the indicating type may be applied to those consumers who have an appreciable demand but whose individual load is not sufficiently large to produce a marked effect on the main power plant; that is, it is unnecessary to have a record of the time when the maximum demand occurred.

When it becomes desirable to know the time that the demand occurred, a recording meter provides a graphic record not only of the one highest demand, but also the demand for each fifteen or thirty minutes' interval, the time of day it occurred and the day of the week.

The type "RO" demand meter is a device in which the time interval is secured by delaying or lagging the operation of the mechanism. The watt-hour meter and the demand meter are assembled together under one cover. In the air gap of the electromagnet element of the watt-hour meter there are two disks, one the regular watt-hour meter disk which registers the kilowatt-hours in the usual manner; the second mounted on a rotatable shaft but limited in its movement by a spiral control spring, thus making this second disk virtually an indicating wattmeter. The indicating-wattmeter element tends to advance the demand needle through proper gearing, but is retarded by an escapement (similar to that in a clock) which is actuated by the revolutions of the watt-hour disk. The load on the watt-hour meter will therefore determine the speed at which the escapement will allow the indicating watt-meter disk to move the demand-meter needle up the scale. If the load is steady during the definite time interval, this arrangement permits the indicating-wattmeter element to reach its final and correct position. For example, if the load is 500 watts on a 10-amp., 100-volt, thirty-minute-interval meter, the indicating-wattmeter element will move the demand needle to its final position of 500 watts in thirty minutes. If the load is 1000 watts, the needle will have to move twice as far, but since the watt-hour-meter disk is also running twice as fast, the escapement is operating twice as fast; hence the demand needle is permitted to reach its final position of 1000 watts in the same time as was the case with the 500-watt load.

Time-interval demand meters are designed to operate at a predetermined length of time. The demand meter itself is either electrically or mechanically connected to the watt-hour meter. We know that each revolution of a watt-hour-meter disk equals a certain number of watt-hours. Mounted in the meter or on the register is a set of contacts, so that with every few revolutions of the meter disk contact is made and then broken. The contacts are connected by wires to an electric magnet in the demand meter and to a battery or other source of electric energy, so that every time contact is made the magnet pulls an armature or lever and then through a pawl and ratchet moves a needle over a scale one division at a time; that is, one division for each contact. At the end of the time interval—say thirty minutes—the needle will have moved a certain distance, *i.e.*, proportional to the average kilowatt load during the thirty minutes. If the load on the meter

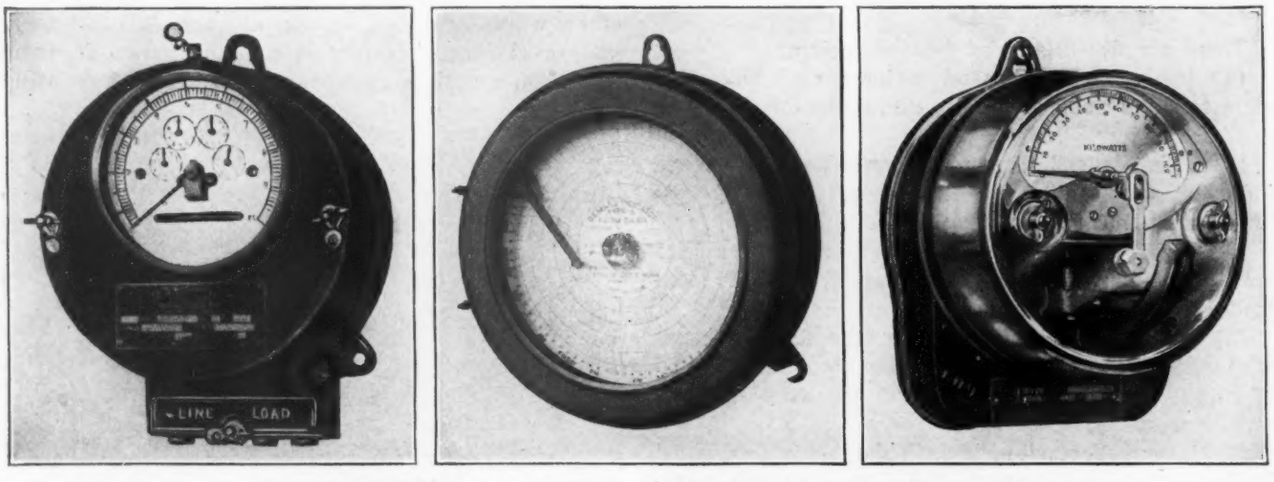


FIG. 2—INDICATING AND RECORDING (CENTER) TYPES OF DEMAND METERS

is small the contacts will not be made very often and the needle will move but a short distance, but if the load is heavy the contacts will be made frequently (with full load on the meter approximately eighty or ninety contacts during the time interval) and the needle will move quite a distance up the scale. The demand has now been measured and the scale can be calibrated to read directly the kilowatt demand. A clock or constant-speed motor is employed in connection with the demand meter, and at the end of the time interval—*e.g.*, thirty minutes—it trips back to zero the mechanism that is pushing the demand needle, and thus the needle is left indicating the demand. After returning to zero the mechanism again starts, and if during this interval the load is less than the previous interval the needle will not be moved, but if the load is greater the needle will finally be reached by the mechanism and be pushed forward to a new and higher reading.

This is the principle of the type "M-4" demand meter. It does not record the time of day when the demand occurred, simply the single maximum demand since it was last read. It is applicable to small or moderately large lighting and power installations, and if a record of the time of demand is not desired it can be used for larger loads. This type can be used with any capacity or make of watt-hour meter and can be calibrated to read directly in kilowatt demand.

Recording Types Described

The type "G" is connected by wires to the watt-hour meter and operated from the same type of contact device as the "M-4." Each time contact is made a pen or stylus in the demand meter moves up one division. There is a clock to drive the recording chart; it also returns the stylus to zero at the end of each time interval. The chart is made of a special wax-coated paper on which the stylus leaves a permanent legible line, the length of which is proportioned to the demand for that time interval, the longest lines being a measure of the highest demands. The chart has an evenly divided scale, and by reading the length of the line the demand is obtained. An eight-day clock drives the chart and also trips back the stylus to zero at the end of each time interval. The type "G" shows the time of day and day of the week upon which the demand occurred, as well as the demand for each interval of time. It is intended for loads where the time of demand should be known. Like the "M-4," it can be used with any capacity and make of watt-hour meter. It is made front-connected or back-connected, also in portable form for testing.

The type "RA" comprises a 5-amp., 110-, 220- or 440-volt polyphase watt-hour meter, together with a roll-chart graphic demand meter mounted on a single base and under one cover. The recording "V" pen is driven by the watt-hour meter through gearing and draws an ink line, the length of the line being proportioned to the demand. At the end of the time interval a fifteen-day clock which drives the chart trips the pen, allowing it to return to zero. The chart has an evenly divided scale, and thus the length of the line shows the demand. A 1.5-kw. and a 3-kw. chart are used on the 5-amp., 110-volt, and the 220-volt watt-hour meters respectively, thus allowing for 50 per cent overload. If used with instrument transformers, it is therefore necessary to multiply the reading by the ratio of the transformers.

The type "P" demand meter, or printometer, prints in plain figures on a continuous paper tape the kilowatt-hours registered by the watt-hour meter during a given interval. It also prints the time of day in a column parallel to that showing the various amounts of energy consumed. A contact-making eight-day clock causes the record to be printed at predetermined intervals. The printometer mechanism comprises a cyclometer counter operated by a plunger and a solenoid from a set of contacts on the watt-hour-meter register. A star and pin-wheel arrangement permits adjustments of the time interval for printing at five, ten, fifteen, twenty, thirty or sixty minutes. The clock is good for only one time interval; it must be changed if the time interval is changed.

Very often on large switchboards it is desirable to have all printometers print at the same instant. The contacts on the clock are not designed for heavy current; hence a relay is operated by one clock, causing all the printometers to print simultaneously.

Advantages of Using Demand Meters

Some of the uses of demand meters have already been enumerated, nevertheless it is well worth while to investigate further their advantages, as follows:

(1) A customer can readily make changes in the apparatus installed without the annoyance of notifying the power company, as the demand will be readily ascertained.

(2) Frequent inspection of the customer's premises is unnecessary when the demand is measured.

(3) The record obtained will tell when investigations should be made.

(4) The demand meter is a definite guide to the size of power transformer to use to secure the best efficiency.

(5) The customer need not hesitate to add to his installation as he requires, as only the power used simultaneously by such apparatus in actual use will be measured.

(6) From the records of the types "G," "RA" and "P" not only the single maximum but two, three or more next highest demands may be used for billing, dependent upon the schedule of rates in use.

(7) The types "G" and "RA" give directly the load curve not only for each day but also for the week.

(8) From the paper-tape record of the printometer the energy used between different periods of the day or week can be obtained as well as the maximum demand and the time it occurred.

(9) From the records a central station is enabled to know constantly all the vital conditions and hence the cost of supplying a customer or any number of customers.

(10) It is possible to check the schedule of rates or to establish a new one and thus insure additional contracts or the installation of other energy-consuming devices.

(11) Knowing the maximum demand and the kilowatt-hour consumption, the load factor can be easily obtained.

(12) By comparing the sum of the maximum demands of various consumers connected to a transformer

or substation to the maximum demand at the transformer or substation the diversity factor is secured. This information bears a vital relation to the investment and proper sizes of transformers, feeders, substations, etc.

(13) With a graphic or printed record it is possible to regulate the use of "off-peak" power, determine the use of break-down services, investigate complaints, make special tests of power conditions and assist new-business departments.

(14) Recording-demand meters and printometers are used for data on generators. Using one on each generator will show the time of greatest demand and the coincident demand of all the generators in the station or on the system, thus permitting only the operation of such equipment as is actually needed.

(15) Department stores and industrial plants can use demand meters to determine the cost of supplying energy to various departments, elevators, charging vehicles, etc.

(16) Large hotels can obtain data that will simplify their accounting and prevent errors in estimates for special functions that might otherwise result in loss.

(17) Operators of office buildings will find demand meters useful in checking the demand for energy by various tenants, for elevators, corridor lighting, ventilating systems, vacuum cleaning systems, etc.

(18) The applications and use of demand meters are easily understood.

(19) Their use enables the consumer to pay his share of the yearly fixed charges in monthly installments, proportional to his monthly demand, while the watt-hour meter tells the proportionate cost plus profits based on the actual energy used.

(20) Central stations adopting measured demand generally use indicating demand meters on power or lighting customers of from 10 kw. or 20 kw. to 100 kw. or 200 kw. and recording demand meters above 100 kw. or 200 kw. Portable recording demand meters can first be installed for the moderate-sized customers for a week or month, and the various demands for various days and periods of the day, also the characteristic cycles of operations, can be obtained; then an indicating demand meter may be permanently installed for billing purposes.

When a recording demand meter is installed the interpretation of its record as applied to factory output can be explained to the consumer. Often the consumer will note that during certain periods of the day the demand for electric power is rather low, thus indicating that the production of his factory may possibly be increased. Further investigation of his factory methods and processes will undoubtedly prove this, and the output can be materially augmented without necessarily increasing the maximum demand. This will aid in increasing the load factor; thus a recording demand meter may often serve as a means of firmly establishing friendly relations with power consumers.

Flat rates became obsolete years ago and were superseded by the watt-hour meter as a basis of measuring the amount of power and the length of time used. Estimating a consumer's demand at 55, 65 or 75 per cent of the connected load is not unlike selling energy on a flat-rate basis.

The value of measured demand to a central station versus the estimated demand is clearly illustrated by actual cases shown in the following tabulation:

Estimated Demand in Kw.	Actual Demand in Kw.	Net Gain for One Month	Estimated Annual Gain Based on This One Month Billing
22	25.9	$10.60	$127.30
25	30.7	15.45	185.40
45	82	105.00	1,260.60
53	169	176.45	2,117.30
60	100	90.70	1,088.60
60	168	212.70	2,552.80
65	72	14.80	177.40
65	90	32.40	388.60
100	144	197	2,360.90
100	226	113.50	1,362.20
100	360	220.20	2,642.20
178	336	203.60	2,443.00
236	382	322.10	3,865.00
Total		$1,714.25	$20,571.30

A loss of $1,714.25 in one month on thirteen customers is not to be passed over casually by the central station. These customers were not paying for all the demand they used when the demand was estimated. Some other consumers must have been making up the difference.

AIRPLANE DIRECTION FINDER A DEVELOPMENT OF THE WAR

Major-General Squier Describes How by the Use of Antenna Coils and an Amplifier a Practical Compass Has Been Devised

In his recent lecture before the American Institute of Electrical Engineers at New York Major-Gen. G. O. Squier, in connection with his description of the war's developments in radio apparatus, already reprinted in the ELECTRICAL WORLD, spoke as follows concerning the problem of aërial navigation:

"One of the principal problems of airplane navigation has been the evolution of a suitable compass, particularly for night bombing work. Magnetic and gyroscopic compasses have limitations at present which make impossible reliable air navigation by dead reckoning.

"The use of directional effects of loops or coils for receiving radio signals has resulted in the development of a radio compass for airplanes which gives positive information to the aërial navigator and enables him either to locate his position by triangulation with respect to two beacon land stations or to fly at any given angle with respect to a certain beacon station.

"The apparatus consists of two principal parts—the antenna coils and the tuning and amplifying apparatus. The antenna coils are mounted in the fuselage of the Handley-Page airplane, with suitable means for rotating in azimuth. The amplifier is extremely sensitive, consisting of a detector and six-stage amplifier. A novel feature of the amplifier is the use of iron-core transformers for frequencies of 100,000 cycles.

"The direction of the beacon land radio station is determined by maximum strength of signals, in a highly ingenious maner developed originally by the British. The precision of the directional effect is remarkable. In fact, the radio direction finder may well be called a radio eye, by which the aërial navigator sees one or more radio lighthouses which are sending identifying signals to guide him on his way. These lighthouses, furthermore, have certain advantages over the normal lighthouse in that their ranges may be much greater and they are not invisible in the daytime nor obscured by fog and mist."

Making a Market for the Central Stations

Basic Principles of Industrial Power Consumption in the New England States—Suggested Means to Increase the Field of Operation of the Central Stations by a Policy of Developing the Industrial Resources of Each Territory

BY L. W. ALWYN-SCHMIDT

DURING the last few years great changes have taken place in the industrial life of the United States. Possibly no industry has been more affected by these changes than the central stations, and it is therefore not surprising that already farseeing central-station managers are wondering what the outcome of these changes will be. There is no doubt that more industrial disorganization must follow. The question is, how far will the industry of the United States be affected by the unavoidable reorientation, and what will be the position of the central stations?

The central stations to-day are better fitted to meet the exigencies of the situation than at any time since the existence of the electrical power industry. Organization methods have been improved. The statistical material supplied by the United States Census Bureau and other organizations has nearly reached perfection. Finally, coöperation between all those interested in public welfare has gained life and has already borne its results in the form of community boosting on a large scale.

The problem facing the central-station manager today is, in short, whether there will be changes in the industrial activity of his territory leading to corresponding changes in the demand for power. What can be done to meet such a possibility? What methods can be employed (1) to avoid a sudden decline, (2) to vitalize permanently the sale of power in a given territory?

The answer to these questions is that the chances of a disorganization of the power sales in a given territory depend upon the industrial composition of the sales territory. There is a possibility of preventing a decline in the power sales by attracting new industries to the neighborhood which will add to the consumption of power, and of vitalizing the sales permanently by giving preference to such industries as give promise of fair prosperity and therefore permanence.

The New England States at present are served by 369 central stations, of which there are 82 in Maine, 57 in New Hampshire, 59 in Vermont, 120 in Massachusetts, 11 in Rhode Island and 40 in Connecticut. The industries of these states in 1909 consumed 218,642 hp. of purchased electric power and 419,197 hp. in 1914, and of all electric power, manufactured and purchased, 663,143 hp. in 1909 and 1,107,677 hp. in 1914. Distributed over the individual states progress in power consumption has been as follows:

	All Power		Electric Bought		All Electric	
	1909 Hp.	1914 Hp.	1909 Hp.	1914 Hp.	1909 Hp.	1914 Hp.
New Hampshire	293,991	344,093	21,209	49,171	45,351	102,612
Maine	459,599	487,211	27,203	46,344	54,266	107,700
Vermont	159,445	173,937	12,917	27,477	21,233	47,161
Massachusetts	1,175,071	1,369,722	109,996	200,339	402,492	582,971
Rhode Island	226,740	269,854	13,697	31,572	42,130	91,229
Connecticut	400,275	453,812	33,620	64,294	97,671	176,009

The industrial activities of the New England States are of a very varied character. Of all the shoes made in the United States 43.2 per cent are manufactured in Massachusetts and 7.9 per cent in New Hampshire. Massachusetts also leads the states of the Union in the manufacture of rubber boots and shoes. Nearly half of the brass, bronze and copper products of this country are made in Connecticut. Connecticut also leads the United States in the making of clocks and of corsets. Of cutlery and edge tools, 28.8 per cent come from Connecticut and 17 per cent from Massachusetts. In textiles Massachusetts and Rhode Island have been the pioneer states. The hat industry is an important industry of Connecticut. Although Massachusetts is using probably half of all the leather tanned in the United States, the state takes only second place as a producer of leather and depends on other states for nearly 70 per cent of its consumption. About two-thirds of all the needles and pins made in the United States are of Connecticut manufacture. Connecticut also takes the leading position in the manufacture of plated ware. Paper and paper stock are manufactured in large quantities in Massachusetts, Maine and New Hampshire. Massachusetts is the third among the states producing rubber goods, and Connecticut takes the same position as a producer of silk goods.

THE MUNITIONS INDUSTRY

In 1914 62 per cent of all the firearms and munitions made in this country were manufactured in Connecticut. Owing to the enormous impetus which this branch of the industry gained during the war speculation as to its further value as a power consumer has been very active. Before the war munitions factories purchased about 25 per cent of their total power requirements from the central stations and generated themselves more than three times as much. After the beginning of the war the proportion changed in favor of the central stations. In Connecticut many new plants have been erected, the great majority of which were merely the extension of existing enterprises. With the end of the war there will, of course, be a contraction in operations, with resulting loss of custom to the central stations from this direction.

The boot and shoe industry felt the vitalizing influence of the war trade. Brockton and Lynn, each with nearly $50,000,000 worth of shoes annually to its credit, Haverhill and Boston are the leading shoe centers in Massachusetts. Manchester, N. H., takes the fifth place. The boot and shoe industry of New England is on an average good for 20,000 hp. of purchased electric power and has increased its requirements very much during the last four years. It is an industry which can easily "lay off" part of its machinery, and a reduction in orders for shoes, therefore, immediately results in a re-

duction of power consumption. Since the outbreak of the war the boot manufacturers of New England have sent out of the country yearly about 3,000,000 pairs of boots above their normal foreign sales. In addition, considerable orders for boots and shoes have been placed by the government. It is likely that not all of this trade will continue.

As the third of the industries of New England affected extensively by the war the textile industry must be mentioned. It is an industry which, while consuming great quantities of electric power, still produces much of it for itself. The great number of operatives incidental to textile manufacture, however, makes districts containing textile mills a valuable territory. The growth of the industry cannot therefore be a matter of indifference to the central station. This is especially the case with cities like New Bedford and Fall River, Mass., where the annual production of cotton goods in each case is valued at more than $50,000,000. Lowell has a cotton goods production of $23,000,000 a year, and in Rhode Island Pawtucket and Warwick are the fifth and sixth among the cotton-goods centers of the United States.

The central stations of New England may now have to face a decline in power demand from these three industries and those allied with them. How far this decline will go is difficult to say. It will be counterbalanced by natural increases in other industrial branches. The New England States possess many industries which have been affected only indirectly by the fluctuations of war business. Cutlery, rubber goods, jewelry, clocks, hats, needles, pins and corsets are all articles which are in continuous demand and the sale of which has not been raised artificially by the unnatural conditions.

Of the industries under discussion the boot and shoe industry uses about 33 per cent of the power it consumes in the form of purchased electricity. The cotton-goods industry is taking only 15 per cent of its total power consumption from the central stations. Foundries and machine shops are taking about 39 per cent, the rubber industry takes 16 per cent and the lumber industry but 5 per cent. Other good central-station industries are the automobile industry, taking about 58 per cent of its total power from the central stations; the paper-box industry, with 39 per cent; the cement industry, with 33 per cent, and the carriage-building industry, with 29 per cent. Electrical machinery takes 32 per cent, and the clothing industry takes 80 per cent or more of its total power requirements from the stations. The glass industry, which in future may play a considerable part in the industries of New England, takes about 8 per cent, the tanning industry 12 per cent, the mineral-water industry 43 per cent. Much stress has been laid on the development of the chemical industry of this country caused by the war, and the New England States seem to offer many advantages for the building up of new chemical plants. The much heralded dyestuff industry, however, so far has taken only 3 per cent of its total power requirements from the central stations. The cutlery industry, so highly developed in Connecticut, and the jewelry industry of Rhode Island are customers of medium importance.

Of more importance to the central station, however, than the growth of already existing industries is the question how to establish new industries and to make such industries prosperous so that they will remain steady customers and attract others of the same class.

The great clay deposits of Maine, already used extensively for the making of bricks and tiles, may open sources of raw materials for the pottery industry of this country, and the large quantities of low-grade lumber formerly lost to the state form to-day a valuable raw material for the paper industry. In a report on the lumber industry issued by the United States Department of Agriculture a series of other industries are named as likely consumers of wood of the cheaper kind. These are the making of fiber board and cellulose fabrics, the production of wood alcohol and acetate of lime from hard woods and of ethyl and grain alcohol from practically all woods, the manufacture of producer gas, and the distillation of naval stores, tanning and tar products. All these are industries which must be established near the raw material they consume, and they are, like most of the chemical industries, appreciative users of electrical power.

As in Maine, the woods of New Hampshire may offer an attraction to many industries now developed only incompletely in that state or absolutely new. The textile industry, however, and the shoe industry may bring the greatest addition to the power consumers in future.

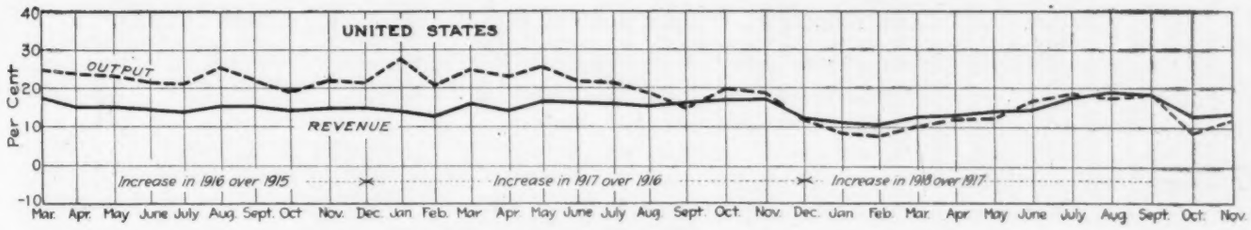
The principal wealth of Vermont consists in its quarries for marble, granite and asbestos, and the great advance made by the stone industry during the last years shows that it has not yet lost its attractions to the investor.

All the New England States seem to offer excellent opportunities for the introduction of a toy industry on a large scale. The toy industry, to be successful, must find surroundings highly developed industrially. Saxony and Thuringia, where the toy industry is at home in Germany, and Bohemia are crowded with industrial enterprises of all descriptions. The reason for this is that probably no other industry requires so much the assistance of auxiliary industries. The lumber, the iron, the textile, the paper, the stone and many other industries must coöperate to make a successful toy industry. Also there must be cheap power, preferably electrical, as this can be had in small units. All this can be found in the New England States. Vermont and Maine would supply the cheap wood, Connecticut the iron and hardware, Massachusetts the textiles, and Vermont the stone. In fact, there is hardly a material needed for toymaking which cannot be secured in the immediate neighborhood if such an industry should be established in the New England States.

One of the principal attractions of Massachusetts is its excellent means of communication. With a network of railroads and tramways it is easy to draw labor to any district where it is wanted, even if it cannot be housed in the immediate neighborhood of the factory.

For the present the best prospects or securing a sound development of the demand for electrical power in the New England States seem to lie in a judicious development of all those industries which have been only indirectly affected by the recent industrial advance and which promise to prosper as a result of returning peace, also in attracting such new industries as those to which reference has been made.

Central Station November Operations


UNITED STATES
OUTPUT
REVENUE
Per Cent
40
30
20
10
0
-10
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov.

HEALTHY GAINS WERE SHOWN IN THE ARMISTICE MONTH

FROM the reports of central-station operations in November, 1918, received by the ELECTRICAL WORLD, it appears that the sudden signing of the armistice in that month caused no appreciable change in the volume of output or revenue. The returns received from the proportion of the industry which was reported up to this date—47 per cent—indicate a gain in revenue of 13.7 per cent over November, 1917, and in kilowatt-hour output of 12.4 per cent. These figures are not far from the level of increase reported for October. They are better, in fact, for the proportion of the industry reported. On the face of the partial returns November therefore showed a closer approach to the relatively high gains of August and September than did the October statistics.

The general situation probably is that both October and November returns were affected by the growing disorganization of normal industry which characterized the closing weeks of the war. Industries which did not contribute resources to the winning of the war were reaching the end of their stocks of materials without hope of replenishment, and the news of the armistice came so abruptly that cancellations could not reach a sufficiently large volume to affect materially the output of factories and therefore the consumption of electrical energy. December returns will present the conditions in the first full month of arrested war preparations. For eleven months of 1918 increase in revenue as compared with 1917 ranged from 8.2 to 18.5 per cent; in output from 6.5 to 18.5 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Dec..	58	$28,144,000	$25,026,000	12.4	1,517,001,000	1,362,299,000	11.0
		1918	1917		1918	1917	
Jan..	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,319,444,000	16.0
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,156,692,000	18.5
Aug.	61	26,891,000	22,690,000	18.5	1,647,510,000	1,417,150,000	16.3
Sept.	60	28,051,000	23,810,000	17.8	1,579,149,000	1,348,820,000	17.0
Oct..	56	26,254,000	23,228,000	13.0	1,517,866,000	1,392,359,000	9.0
Nov.	47	20,686,000	18,195,000	13.7	1,049,695,000	933,226,000	12.4

Based on the November returns from 47 per cent of the industry, the ELECTRICAL WORLD estimate of operations for the entire industry for that month is: Total revenue, $44,000,000; output, 2,233,400,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				Central States				Pacific and Mountain States			
		Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase
REVENUE	Dec.....	64	$3,483,000	$2,999,000	16.1	58	$10,834,000	$9,949,000	8.8	48	$8,935,000	$7,464,000	19.7	82	$4,892,000	$4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.....	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.....	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	Mareh.....	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April.....	62	2,890,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May.....	62	2,810,000	2,530,000	11.5	64	9,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June.....	63	2,925,000	2,584,000	13.3	63	10,048,000	8,761,000	14.7	49	8,124,000	6,824 000	19.0	84	4,973,000	4,432,000	12.2
	July.....	62	3,037,000	2,511,000	20.9	62	9,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug.....	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	51	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sep.....	64	3,268,000	2,811,000	16.2	57	10,143,000	8,631,000	17.5	51	9,251,000	7,703,000	20.1	86	5,389,000	4,665,000	15.5
	Oct.....	63	3,360,000	3,036,000	10.6	51	8,822,000	7,924,000	11.3	50	9,218,000	7,848,000	17.4	81	4,854,000	4,420,000	9.8
	Nov.....	58	3,551,000	3,120,000	13.8	45	8,293,000	7,429,000	11.6	32	4,459,000	3,721,000	19.8	74	4,383 000	3,925,000	11.6
KW.-HR. OUTPUT			1917	1916			1917	1916			1917	1916			1917	1916	
	Dec.....	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.....	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.....	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March.....	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April.....	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May.....	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June.....	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July.....	62	135,960,000	105,373,000	29.0	62	518,566,000	435,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug.....	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	51	447,829,000	399,278,000	12.1	85	488,433,000	413,350,000	18.1
	Sept.....	64	133,901,000	114,279,000	17.1	57	520,312,000	445,154,000	16.8	51	471,594,000	408,320,000	15.5	86	453,342,000	381,067,000	18.9
	Oct.....	63	139,784,000	128,970,000	8.3	51	481,222,000	440,268,000	9.3	50	479,990,000	442,054,000	8.5	81	416,870,000	381,067,000	9.4
	Nov.....	58	132,333,000	117,751,000	12.3	45	355,808,000	312,334,000	13.9	32	191,669,000	168,261,000	13.9	74	369,885,000	334,880,000	10.4

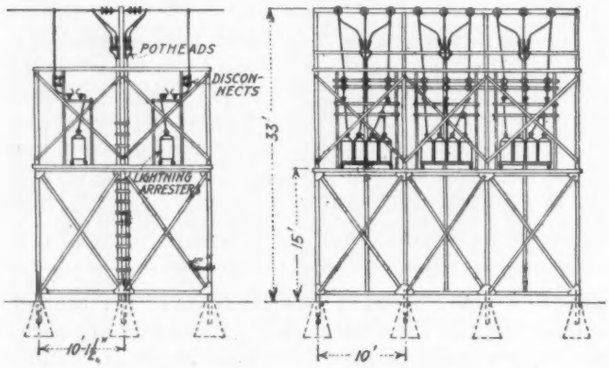
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STEEL RISER STATION OF PERMANENT DESIGN

Concrete Gallery Floor Supports Arresters and Potheads—Space Provides Protected Junction for Overhead and Underground Systems

There seem to be certain sections of nearly all distribution systems which are commonly built in a more or less temporary manner. On this account the necessity of rebuilding them arises frequently. The natural result is undue expense and unnecessary wasting of materials. Gradually this general fact is being recognized, and steps to combat what appeared to be a growing tendency are being taken. Riser stations between overhead and underground systems are an example



APPARATUS ARRANGEMENT ON STEEL SUBSTATION STRUCTURE

of this class of construction. In some cases, of course, it would be unwise to build a permanent riser station when the trend of growth of the city showed it would have to be moved farther out in a short time. On the other hand, there are instances when good judgment should dictate a permanent installation.

Such an instance recently came to the notice of the Central Illinois Light Company of Peoria. The company took advantage of the situation to build a permanent riser station of concrete and steel for its 13,200-volt lines. It is built on a triangular plot of ground which otherwise would probably remain unused, at a distance of about 1.4 miles (2.25 km.) from the power plant. The site is properly fenced, but as a further protection the live parts of the station are all placed on a floor 15 ft. (4.6 m.) above the ground. The station measures 20.5 ft. wide by 30.25 ft. long by 33 ft. high (6 m. by 9 m. by 10 m.). The framework is entirely of angles, channels and plates. The sections used throughout are comparatively light, but the station carries little weight and is well braced. The supports are set in concrete piers, and the apparatus floor is made of concrete 3 in. (7.6 cm.) thick.

The electrical circuit arrangements are simple, consisting merely of cables brought up from the underground conduit to the top of the station in an iron pipe, where they terminate in disconnecting-type potheads. The overhead lines are dead-ended on strain insulators at the top of the station and are connected to the pothead through open-wire taps. Connections for the aluminum-cell lightning arresters are taken off through disconnecting switches mounted above the arresters on an iron-pipe framework.

Up to the present time only one set of lightning arresters has been installed, but all provisions have been made for others, even to casting the bolts into the concrete floor. It is expected that other 13,200-volt lines which now go to the power house overhead will ultimately go through this station.

1200-HP. MOTOR REPLACES STEAM ENGINE IN ROD MILL

Results in a Saving in Operating Cost and Better Driving Characteristics—Liquid Rheostat Used for Speed Control

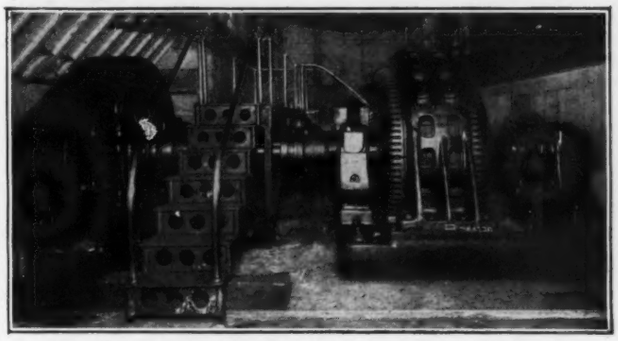
A 36-in. by 48-in. (91-cm. by 121-cm.) steam engine which formerly drove a Morgan fourteen-pass continuous-rod mill at the Grand Crossing works of the Interstate Iron & Steel Works, Chicago, has been replaced by a 1200-hp., 360-r.p.m. motor. On overloads the motor will deliver 2000 hp. for one-half hour. In addition to a marked saving in operating costs, this replacement of the steam drive by electric motor drive has made possible a uniform starting torque with starting loads as high as 2000 hp. This is desirable, as formerly the steam engine caused difficulty in starting under load. The simplicity of the induction motor as compared with the steam engine means less trouble of every kind. There is no loss of time caused by stops on center. The possibility of flywheel racing is eliminated as it cannot run above the synchronous speed of the motor. This electric drive has been in successful operation for four months.

The motor is equipped with liquid rheostat control, which provides greater flexibility in this instance than the magnetic type would have afforded. The liquid rheostat control is, moreover, lower in initial cost and maintenance. The rotor leads are brought out to plate terminals in the rheostat. A small motor circulates the electrotype of the rheostat around cooling coils to keep the temperature down.

A desirable feature of this drive is its flexibility. As the speed reduction of the motor to the main drive shaft of the rod mill is four to one, a reducing gear stand is employed, the motor being connected to the spindle of this through a shaft 4½ in. (10 cm.) in diameter. This shaft is made large enough to take the starting torque

and is also designed to break in case of excessive strain between the motor and driving system, thus protecting the motor and reducing vibration in the slots of the rotor.

The driven gear, which operates at 90 r.p.m. is connected to the crank disk of the former engine by a steel shaft 19 ft. (6 m.) long and 7 in. (18 cm.) in diameter.



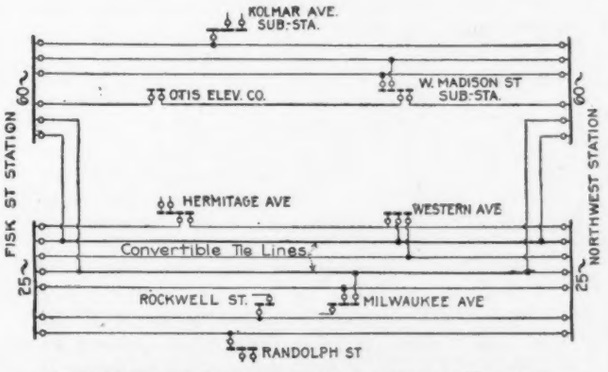
SIMPLICITY AND RELIABILITY FAVOR ELECTRIC DRIVE

This long shaft is necessary to take up the "whip" or torsional strain set up between the 22-ft. (7-m.) flywheel on the main shaft of the mill, which drives the finishing gear trains through a belt, and the large 8-ft. (2-m.) diameter-driven gear in the reducing gear stand.

TIE LINES ARRANGED FOR USE AT TWO FREQUENCIES

To Save Investment in Copper Scheme Is Devised to Permit Operation of Certain Lines on Either 25-Cycle or 60-Cycle System

Between its Northwest and Fisk Street stations the Commonwealth Edison Company of Chicago operates two sets of lines. One group operates at 9000 volts, 25 cycles, and the other at 12,000 volts, 60 cycles. All of the lines are usually loaded at intermediate substations. Ordinarily it would have been the practice to have available spare capacity enough in each group of tie lines to take care of an emergency. The increasing



BY USING TIE LINES INTERCHANGEABLY FOR 25-CYCLE OR 60-CYCLE SERVICE LESS RESERVE CABLE IS NEEDED

price and the scarcity of copper have, however, led to the development of a plant by which one set of spare lines can be used for either the 25-cycle or the 60-cycle system. The scheme is merely one of providing a system of electrical connections and switching interlocks, so that the lines can be switched to either the 25-cycle or the 60-cycle bus but can by no chance become connected to both. The convertible tie lines are normally operated as a part of the Commonwealth Edison's 25-cycle system.

The general layout of the two systems of tie lines between the Northwest station and the Fisk Street station is shown in the diagram. When the convertible lines are switched from the 25-cycle to the 60-cycle system the substation load intermediate between the two stations which they may be serving is then served from other 25-cycle feeders.

While this idea for saving tie-line copper has been discussed here as it pertains to lines between two principal generating stations, it has also been found applicable for lines between a generating station and a substation where the substation carries both 25-cycle and 60-cycle loads, and it might also be worked out for service between two substations.

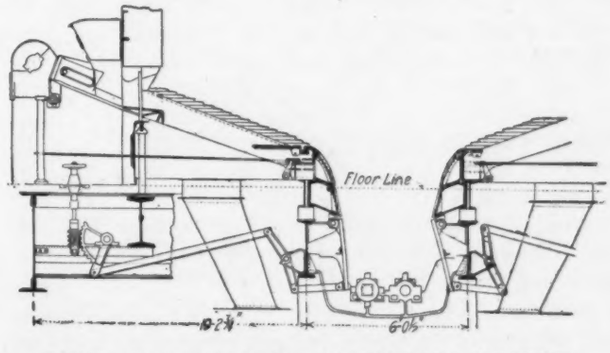
REBUILT ASH DISCHARGE FOR DETROIT FURNACES

Toe of Stoker Is Curved to Eliminate Break in Fire and Special Clinker Grinders Have Been Developed

The Detroit Edison Company's engineers have done a great deal of work in the development of clinker grinders. Considerable difficulty was encountered at first on account of the fact that there was a breaking of the fire where the fuel left the underfeed part of the stoker, going into the ash well. A section of a boiler and stoker equipment installed at the Delray plant of the Detroit Edison Company is shown herewith.

The installation is a 2365-hp. Stirling boiler equipped with a twenty-six-retort underfeed stoker with clinker grinders. It will be noted that the grate surface in the installation, as it now stands, is curved. This construction was adopted in order to eliminate breaks in the fire.

These facts were brought out by J. G. Worker of the Westinghouse Electric & Manufacturing Company before a recent meeting of the station-operating committee of the Ohio Electric Light Association.



BOILER AND STOKER AT DELRAY PLANT OF THE DETROIT EDISON COMPANY

This equipment is ordinarily operated at about 150 per cent of boiler rating, but higher capacities can be obtained when necessary. The coal ordinarily used contains about 13,200 B.t.u. as fired and 10 per cent ash. Under these operating conditions the combustible in the ash runs from 14 per cent to 18 per cent.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

PREPARATION OF WOMEN FOR INSPECTION WORK

Owing to Lack of Previous Mechanical Training, It Has Been Found Necessary to Teach Them Only One Operation at a Time

The Consolidated Gas & Electric Company of Baltimore has been training women for inspection work, such as is usually handled by the so-called "troublemen," it is reported by the federal Board for Vocational Education.

The woman worker is sent out with a repair man on the job for about a week. During this time she learns what she can of the conditions which are the chief cause of complaint. After this week of road work she is placed in a class for instruction, three or four women being trained for the work at one time. The class instructor takes up the adjustment of various forms of lighting and heating apparatus, together with such other problems as are encountered in the regular routine of the work. This class instruction continues for about two weeks, at the end of which period the woman resumes her road work. A workman accompanies her about one-half of the day. This time is gradually reduced until after two or three weeks she works alone, except for one hour of the day, when she is accompanied by another workman.

The superintendent of the complaint department states that this type of instruction is essential to give the woman the necessary confidence in herself. He also states that because of the lack of general mchanical information and the opportunity to use tools, he finds it necessary to teach only one operation at a time; that is, he will put the women at the adjustment of lamps first, gradually work them into the adjustment of other appliances, and then into general trouble repairing. The company had eight women in this service on Nov. 1 and considers an increase in the number desirable.

TEACHING EMPLOYEES TO BRING ABOUT GOOD WILL

Hartford Company Issues Set of Instructions Designed to Cause Courteous Treatment of Customers by the Company's Servants

That the customer must be satisfied is coming more and more to be the slogan of electric lighting companies. Evidences of this policy are becoming more frequent. One good example of it is offered in the set of instructions recently issued to the employees of the Hartford Electric Light Company. These instructions, which are printed in the following column, lay special emphasis on the impolicy of wrangling with customers or making promises without being sure that they can be kept.

NOTICE TO EMPLOYEES OF THE HARTFORD ELECTRIC LIGHT COMPANY

This company is operated to sell electricity, and incidentally such other equipment or appliances as will make electricity available. Without customers there would be no Hartford Electric Light Company.

These are simple facts, easily understood. It therefore behooves every man and woman in our employ to remember this always and to see that every customer is treated with courtesy and proper consideration.

See that you do your part to make the customer feel that everybody's business is appreciated, and impress upon him the "no trouble to show you" spirit. When a customer walks in meet him halfway by showing an interest in what he wants or any information he may be seeking.

At rare intervals some perverse member of our force disagrees with some customer as to the rightness of this or that. He maintains that he had no instructions to make a quick connection, when the customer says he had, or that the order was for 60-watt lamps instead of 40-watt, or that this was ordered and not that.

Either may be right.

These are permanent instructions: No employee of the Hartford Electric Light Company is allowed the privilege of arguing the point with the customer. He must adjust the matter at once in a pleasant and satisfactory manner to the customer, or call his superior to adjust it. Wrangling shall have no place in the Hartford Electric Light Company.

The very good reason that our business is successful is that we give good service at reasonable rates and we have the right kind of people to handle the business. Every one from the errand boy to the president of the company is working to give the customer the service he wants.

It is the object of the Hartford Electric Light Company to sell to its customers just what is wanted and give with it the very best of service. Service means the limit of courteous, efficient attention from each particular employee to each particular customer or order. It rests with every employee of this company whether the customer goes away disappointed or pleased. We have a reputation for rendering service which the head of every department is instructed to maintain.

If the customer asks for a quick connection, do not get rid of the matter by answering: "It will be made right away," without knowing or getting information from the proper department whether it is possible to accommodate the customer. Sometimes it is impossible to make the delivery the customer wants, and sometimes no trouble at all when you explain the importance of the delivery to the proper department.

Always remember the customer pays your salary. He is your immediate benefactor.

DISCONTINUANCE OF FREE FUSE POLICY PROFITABLE

Harrisburg Company Also Expects by Teaching Customers How to Renew Fuses to Increase Energy Consumption

The Harrisburg (Pa.) Light & Power Company states that it is beginning to notice the result of the institution of a charge on fuse plug renewals, reported in the ELECTRICAL WORLD for Nov. 2. A few months ago the company discontinued free renewing of burnt-out fuse plugs and made a charge of 10 cents each for all sizes of plugs and a further charge for time in delivering and installing. The revenue from the sale of fuse plugs now amounts to from $50 to $60 a month, and the income for delivering and installing is quite an item, formerly charged up under the head of "gratuitous service" and lost.

A steady effort is being made to educate the consumer as to how to renew his fuse and to impress upon him that he should be provided with extra plugs and be ready to restore the service promptly whenever a blow-out occurs. This in itself will amount to considerable money in the course of a year in energy consumed during the period when, in the past, the meter stood idle waiting until the troubleman could get around to put it in running order again.

WAR PROVES STRENGTH OF BUDGET AND EXPENSE PLAN

Rapidly Changing Conditions of Recent Years Also Cause Changes in Operating Methods of Chicago Company's Committee

While the budget and expense committee idea as a method of planning and executing operation of central-station properties is not new, this plan as applied to the operation of the Commonwealth Edison Company, Chicago, has withstood the war period so well that it seems appropriate to review some of the facts concerning the company's plan and to point out some of the changes which the war period has made it seem advisable to work into the plan. The budget and expense committee system, as it was originally adopted by and operated by this company, was described in a paper by T. J. Walsh before the Philadelphia convention of the National Electric Light Association in 1914. This paper contained illustrations of the various forms and records employed in keeping data for the committee and also described the method by which each department head received the information necessary to make a scientific study of the particular expenses for which he is held responsible.

Before America entered the war the company was using a budget preparation period of twelve months, but afterward, when it became apparent that conditions in the industry would change with great rapidity, the period for which budgets were prepared was reduced to three months. The belief is now expressed that, since the advantages of using the shorter period have been thoroughly demonstrated, the company will not revert to its former practice. The chief advantage of the shorter period is the greater ease of foreseeing conditions and contingencies that might arise during a period of three months than over a period of twelve months.

Now, as in the past, the tangible work of the budget committee finds expression in its reports on the operation of the company and its departments. These are kept both in tabulated and graphic form. Tabulated data are reduced to unit figures, the units for each department being selected as those which will most accurately portray the changes in the surrounding conditions. Meter department data, for instance, use the number of meters as the basic figure in arriving at unit cost. Likewise the bookkeeping department bases its units on the number of customers. Many of these departmental reports are carefully subdivided to bring out information which will be particularly valuable in determining the correctness of company policies. An instance of this is the detailed information kept on the renewal of incandescent lamps.

The graphical data have a dual use. On these curves the unit figures are plotted in a solid line for the current year. Alongside this curve a broken line shows the similar units for the preceding year. On the margin may be indicated in figures the average unit figure for each of several preceding years.

In scanning these curves the committee not only looks at the current point on the curve but carefully observes the general trend of the graph. This observation is one of the most valuable practices that grow out of this method of operation. If the trend of the curve is upward and if the factors that enter into the formulation of unit figures are within the control of the officers of the company, as would be the case with cost of delivery of lamps and appliances or gratuitious repair of cord and appliances, corrective measures can be and are taken. In fact, action has been taken in this particular instance by instituting a delivery charge and by discontinuing considerable of the gratuitious service which the company had formerly rendered for its patrons.

On the other hand, if the factors controlling the data on which the curve is based are not within the control of the committee, as is the case with the price of coal, an upward trend of the curve can only be taken to indicate that it is necessary to reduce expenses in other quarters or to find methods of increasing the revenue. The committee is just as quick to take under consideration a plan for increasing the revenue of the company as a plan for decreasing the expenses. The topics discussed at its meetings, which are held weekly at a stated hour, range all the way from broad questions of general economics to those of departmental expense.

Taken on the whole, it is thought there are two important things which the employment of a budget and expense committee plan of operation permits a central-station company to do. First, it permits the officers of the company to formulate in advance a more or less accurate and definite idea of what expenses and income will be over a stated period. Second, it is necessary for department heads to plan for their expenditures in advance and to provide estimates of these expenses. Moreover, they strive, on account of company and departmental pride, to limit the expenditures in the operation of their departments to the figures which are shown.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Changing a Direct-Current Machine to a Synchronous Converter.—M. W. SMITH.—The purpose of this paper is to show the relation between a direct-current machine and a synchronous converter, and in a general way to show the possibilities and difficulties in changing a direct-current machine to a synchronous converter. Enough of the principles and relations are shown to allow each particular case and combination of windings to be worked out.—*Electric Journal,* November, 1918.

Connections for Voltage Transformations.—E. G. REED.—Connections used in practice for obtaining various voltage and phase transformations are taken up as follows: (1) Single-phase, (2) three-phase by the various combinations of the star and delta, (3) three-phase open delta, (4) three-phase T, (5) interconnected star. —*Electric Journal,* November, 1918.

Transformers for Electric Welding.—W. S. MOODY.—Transformers for electric welding fall into two distinct classes, those for spot welding and those for arc welding. The main requirements of the first type are the ability to carry exceedingly heavy currents ranging from 50,000 amp. to 75,000 amp. and a compact construction, owing to the fact that the transformer is of necessity an integral part of the welding machine. The very large currents necessary for heavy work and the consequent heating require some artificial means of cooling the windings, and water circulation through hollow conductors is the means generally employed. The arc-welding transformer is required to supply a constant current ranging from 60 amp. to 250 amp. and an open-circuit voltage of from 100 to 150. Some means must be provided for changing the current supply to meet the requirements of the work. Mr. Moody enumerates the service requirements of each type of transformer and describes the construction that has been found best to fulfill these requirements.—*General Electric Review,* December, 1918.

Wave-Shape Standard.—HAROLD S. OSBORNE.—The paper gives a review of the work done during the past three years by a sub-committee of the standards committee of the Institute appointed to make recommendations for changes in the Institute's rule regarding the wave shape of alternators. After a very careful consideration of the question and a large amount of experimental work the sub-committee last spring made recommendations that for the present the 10 per cent deviation rule should be retained without change (except in wording), and that trial use should be made of a supplementary wave-shape factor. The new factor, based on the relation between voltage wave shape and interfering effect in telephone circuits, when power and telephone lines parallel each other, is called the "telephone interference factor." The committee invites the broadest discussion and trial use of the new factor. No attempt will be made to decide upon limiting values of the factor until after wide experience shall have been obtained in its use, and the committee will welcome assistance on the part of any interested in collecting information to this end.—*Proceedings A. I. E. E.,* January, 1919.

Reconnecting Induction Motors.—A. M. DUDLEY.—In this article is discussed the reconnection of the stator winding for a change in the number of poles. The effect on the shape of the magnetic field of changing the throw of the coil is described, and how reconnecting a given winding for different numbers of poles has the same effect as changing the throw of the coil.—*Power,* Jan. 7, 1919.

Changing the Speed of Induction Motors.—GORDON FOX.—It is shown that by rearrangement of the coils induction motors may be adapted to the operation at a considerable variety of speeds.—*Railway Electrical Engineer,* December, 1918.

Lamps and Lighting

Fundamentals of Illumination Design.—J. R. COLVILLE.—This is the first article of a series dealing with illumination design and covers fundamental concepts. It deals particularly with measurement and photometry.—*Central Station,* December, 1918.

A Method of Shipway Illumination.—F. B. WEBER.—The temporary character of the ways and the extreme flexibility required of the illumination make the problem of efficiently lighting shipways one of some difficulty. In this article an effective system as worked out by the Northwest Steel Company of Portland is described.—*Journal of Electricity,* Dec. 1, 1918.

Generation, Transmission and Distribution

Firing of Pulverized Lignite.—M. C. HATCH.—With the extensive lignite fields of the West and Southwest and the scarcity of other coal, any means which may be devised for the economical use of this fuel will be of utmost importance to Western industry. That lignite may be efficiently used in its pulverized state for locomotive and stationary furnaces has been demonstrated both in the Northwest and elsewhere.—*Journal of Electricity,* Dec. 15, 1918.

Lubricating Central-Station Machinery.—NEWTON HARRISON.—Tabulated data are given for the friction coefficient for different loads and lubricants. General methods of lubrication are compared, and the proper lubrication of different machines such as dynamos and motors, steam turbines, etc., is given.—*Central Station,* December, 1918.

Power-Plant Management.—ROBERT JUNE.—This is the fifth article of a series on power-plant management

devoted particularly to standard practice for hand firing. It deals especially with the maintenance of the proper thickness of fire and the elimination of smoke.—*Central Station*, December, 1918.

Exhaust Steam at High Back Pressures.—CROSBY FIELD.—A system of charts based on thermodynamical formulas and data with reference to boiler pressures and cut-offs.—*Chemical and Metallurgical Engineering*, Jan. 1, 1919.

Properties of Liberty Fuel and Results of Economy Tests.—Liberty fuel, the invention of Captain Weisgerber, consists of kerosene treated chemically with the result that its oxygen content is increased, so that when the fuel is vaporized and admitted to the engine cylinder there is present some of the oxygen needed for the process of combustion. The heat value attributed to this liquid fuel per gallon is 127,900 B.t.u. as compared with 119,200 B.t.u. for commercial gasoline and 112,300 B.t.u. for export gasoline. Curves showing the relative economy of Liberty fuel and export gasoline are presented in this article.—*Power*, Jan. 7, 1919.

What Percentage of CO_2 Can Be Obtained?—Fuel saving urged by the Fuel Administration is difficult, if not impossible, without a knowledge of the percentage of the CO_2 formed. The percentage of CO_2 found in the flue gases from a boiler depends on the efficiency of combustion, but the maximum percentage attainable is governed by the percentage of hydrogen in the fuel.—*Power*, Dec. 31, 1918.

Control of Concentrated Boiler Water Is Essential.—HARTLEY L. SMITH.—The writer states that corrosion and the deposition of scale are due solely to the chemical nature of the water in the drums and tubes. This is totally different from that of the feed water and is not a mere difference of concentration. He discusses the methods used for the control of concentration in boilers, shows how the ratio of concentration from feed water to boiler water is determined, and describes the calculation of boiler concentration control charts.—*Electric Railway Journal*, Dec. 21, 1918.

Traction

Automatic Electrically Driven Water-Station Pumps.—It is shown how a railroad conserves labor and fuel by automatically governing motor and heating apparatus.—*Railway Electrical Engineer*, December, 1918.

Electrical Equipment at the Scranton Shops.—The extensive use of alternating and direct current in operating steam tools and other devices used in the shops of the Delaware, Lackawanna & Western Railroad is described.—*Railway Electrical Engineer*, December, 1918.

Interurban Cuts Power Consumption One-Half.—Revolutionary methods in interurban railway operation and car design involving cutting the weight of the interurban car by one-half indicate new tendencies in the operation of electric railways.—*Electric Traction*, November, 1918.

Installations, Systems and Appliances

Selecting an Arc-Welding Equipment.—J. W. HAM.—A brief summary of the various phases of arc welding that must be taken into consideration when selecting equipment.—*General Electric Review*, December, 1918.

Study of the Joining of Metals.—J. A. CAPP.—The purpose of this article, as stated by the author, is to report an investigation made to determine the best practice in making butt welds by the Thomson electric-welding machine. Three classes of welds were made,namely, (1) with high current applied for a relatively long period, (2) a smaller current applied for a shorter time, and (3) a current just large enough to produce a welding temperature when applied for the minimum length of time. A microscopic study of these welds shows that the degree of excellence is increasing in the order given, the welds made under condition (3), after annealing, being hardly distinguishable from the body of the sample bars made under each of the three different conditions.—*General Electric Review*, December, 1918.

Electric Welding for Shipbuilding.—W. S. ABELL.—The improvements in electric welding have opened up considerable possibilities of its extended application in shipbuilding. It is the author's opinion that until some practical experience on a fairly large scale has been obtained welding should be applied to the structural members of a vessel exceeding 300 ft. (90 m.) in length, but even for smaller vessels there is ample scope for the introduction of this system of construction. It would appear safe to say that for vessels of moderate dimensions the use of electric welding will become exceedingly common, with possibilities of extension to vessels of larger size as experience is gained and further research approaches to perfection in the process of welding. With added experience he holds there is no question that the process will be extended to larger vessels.—London *Electrician*, Nov. 22, 1918.

Industrial Controllers.—H. D. JAMES.—This is the twenty-third number of a series on industrial controllers, this article being devoted particularly to the following protective devices: (1) Overload, (2) low voltage, (3) phase reversal, (4) phase failure, (5) shunt field failure. These devices are taken up in considerable detail.—*Electric Journal*, November, 1918.

Oscillating Phase Advancers.—C. W. KINCAID.—Oscillating phase advancers are used in connection with wound-rotor induction motors to increase the power factor of the current taken from the line by the motor. They are distinguished from other types of phase advancers in that they do not rotate continuously in the same direction but make only a few revolutions in one direction before they reverse and rotate in the opposite direction. The applications of oscillating phase advancers to induction motor practice are explained in this article.—*Electric Journal*, November, 1918.

Electrophysics and Magnetism

Mean Power and Power Factor in a Non-Sinusoidal Alternating-Current Circuit.—H. PÉCHEUX.—The author presents a method of calculation for determining the power factor of a network by the use of oscillographic curves of voltage and current. This method was formerly employed by the author (*Revue Générale de l'Electricité*, Feb. 3, 1918) for the determination of the non-sinusoidal emf. of an alternator.—*Revue Générale de l'Electricité*, Nov. 30, 1918.

Determination of Electric Fields of Insulators by the Electrolytic Method.—W. ESTORFF.—The author describes an electrolytic method which he has used for

investigating the electric stresses on insulators. The method is based upon the similarity existing between the representation of the lines of the electric field and the lines of current flow in an electrolyte. The equipotential lines between two electrodes are obtained by means of a probe, using a Wheatstone bridge and telephone. Alternating current is employed in order to get rid of polarization effects. The probe forms the tracer of a pantograph arrangement by means of which the equipotential surfaces can be traced out on an enlarged scale. The method is first applied to the examination of a suspension insulator, and, as an example of the utility of the method in aiding the design of insulators, it is shown how the distribution of the field is changed by altering the insulator from (1) a chain of four similar insulators with equal disks to (2) a similar chain but with enlarged end disks, (3) a similar chain but having increased capacity of the end members, and (4) a similar chain combining both modifications (2) and (3). The electric field diagram shows the more equally distributed field obtained by arrangement (2) as compared with (1), but this advantage is obtained at the expense of increased total capacity, which means that a larger number of lines of force terminate on the end plates, and results in diminished dielectric resistance.—*Science Abstracts, Section B*, October, 1918. (Abstracted from *Elektrot. Zeits.*, February, 1918.)

Electrochemistry and Batteries

Cost of Synthetic Nitric Acid in France.—Before the war nitrate of soda cost 24 francs per 100 kg. c.i.f. a European port, or 1.50 francs per kilogram of nitrogen. Although this price doubled during the hostilities, it will probably return with normal conditions. Can France obtain nitric acid from the atmosphere cheaply enough to compete with that imported from Chile? The author says no, if the Birkeland-Eyde process is used, and yes, if a more efficient process or an improvement on the Norwegian method can be employed. During the war much progress in this direction has been made by the French Service de l'A. N. S. (acide nitrique synthétique). Its methods are still secret, but among the lines of work followed is that of the over-oxygenization of the air by the Claude process. In place of the ordinary atmospheric proportions of 21 per cent oxygen and 79 per cent nitrogen, it is possible by this process to employ a mixture with only 72 per cent of nitrogen, corresponding to N_2O_5, which increases the output of the oven 30 per cent, making it possible to obtain from large ovens 780 kg. of nitrogenous acid per kilowatt-year. But even with this result the price of a kilogram of oxygen, with energy at 2 centimes a kilowatt-hour, would be 2.33 francs, or much more than the cost of the Chilean article.—*Journal du Four Electrique*, Dec. 1, 1918.

Electric Steel Furnaces; Utilization of Scrap.—Before the war munitions makers found themselves accumulating large quantities of borings, turnings of high-grade steel which were of comparatively little value although they contained chrome and nickel and other costly elements. The real difficulty was to remelt these scraps without losing their valuable contents. When the munitions works began to make enormous quantities of these turnings it was realized that something should be done to make use of these waste products. It was recognized that by the electrical process it was possible to remelt without losing a large percentage of the alloying metals. Two types of industrial electric furnaces which have recently been put on the market are briefly described. Of the Greaves-Etchells it is said that it is now possible to have "boils" of as much as 12 or 15 tons entirely of scrap as compared to a limit of about 2½ tons before the war. Concerning the Stobie type of furnace special attention is given to the prevention of leakage of heat around the entrance of the electrodes into the furnace.—London *Times Engineering Supplement*, November, 1918.

Telegraphy, Telephony and Signals

Radio-Telegraphy in Germany and in France.—M. Bouthillon.—In 1900 the German Wireless Telegraph Company established at Nauen an experimental station where electric waves were produced with a 35-hp. plant. To-day with 1000-hp. generating capacity, the plant is able to send messages more than 10,000 km. In 1912 there was one tower 200 m. high and three 150 m. high. To-day the former tower, which was destroyed in a storm, is replaced by two towers 250 m. in height. In 1915 connection was established with Sayville, N. Y. In that year 1,300,000 words were sent by wireless from Nauen; in 1916, 2,580,000 words, and from January to September, 1917, 3,680,000 words—an increases rendered possible only by raising the speed of transmission from 100 to 250 words a minute. In France it is now possible by the automatic duplex service to reach during at least six hours a day in summer and twelve hours in winter an output of 140 words a minute. This output is susceptible of great increase by the employment of multiplex apparatus permitting the sending or receiving of many telegrams with the same antenna; but the comparison with Germany favors the enemy country.—*L'Industrie Electrique*, Sept. 25, 1918. (Abstracted from *Génie Civil*, Aug. 3, 10 and 17, 1918.)

Miscellaneous

National Factories; Their Utilization for Electrical Industries.—This article deals with the possibilities of using munitions plants for electrical manufacturing purposes. While a large number of these plants are of flimsy construction and are therefore to be scrapped, there are nevertheless many plants well equipped and more substantially constructed which might well be used for other purposes instead of being dismantled. In all cases first-class internal railroads of standard gage have been laid down, and water supplies, sewage arrangements and fire-hydrant services, etc., are complete. The buildings, moreover, are well lighted and heated, frequently provided with hydraulic power, electric power and sometimes gas. Housing and canteen accommodations are usually connected with the factories, and these points should be considered by electrical manufacturers who are factory hunting.—London *Electrical Review*, Dec. 6, 1918.

Works of the Union Cable Company.—The layout of a cable factory may seem simple enough at first glance, but it requires considerable thought to avoid overlapping of effort and the rehandling of raw material and semi-manufactured material. The Dagenham works of the Union Cable Company are described in this article.—London *Electrician*, Nov. 15, 1918.

Power Factor of Arc-Welding Sets

To the Editor of ELECTRICAL WORLD:

SIR: Power factor is being held up by many of the direct-current arc-welding apparatus manufacturers as a bugaboo to account for the difference in first cost and cost of operation and maintenance between direct-current and alternating-current arc-welding machines. As a matter of fact, the power factor of the latter is no worse than is the case with any induction motor-generator direct-current set on an average all-day run of arc weld, and further because of the alternating-current set making but one simple change and demanding but 3 kw. to 5 kw. as against 7½ kw. to 75 kw. for direct-current sets, it causes less disturbance on a power line. Arc welding is intermittent, either on full or all off, and a short circuit is used to start the arc. No more primary current is drawn by our alternating-current set on short circuit than when running, while a direct-current set draws from one and one-half to twice full-load current, and when an induction direct-current set starts up from two and one-half to four times full-load current is drawn, while our alternating-current sets draw no more current starting than when in operation. Moreover, during operation our control of the current and volts is more even than any direct-current set, no wild peaks of either being allowed, and the primary wattage, and hence current because voltage is constant, is smooth and without peaks or hollows.

Power factor is not efficiency—our set is the most efficient of all welding sets and equal in power factor to any. It is also the lightest in weight, and hence portable; has no maintenance, and consumes no power when not in actual operation. All direct-current sets take a continuous flow of power to keep them ready for striking the arc.

Power factor is the ratio of kva. asked for to kw. used. It is like sending for goods on approval. If half are kept, that is similar to 50 per cent power factor; the goods not kept are returned to stock, and no one pays because no one used them. Fifty per cent power factor means that out of 100 amp. 50 amp. is kept and 50 amp. returned to stock. The meter registers only 50 amp., the other 50 amp. was out of step and did not combine with the volts to make watts.

"Volts" and "amperes" are only terms of mathematical convenience; the only term that exists is watts, or the rate of energy, which, when taken over a period of time, is what is paid for, *i.e.*, kilowatt-hours.

Our power factor in welding runs from 35 to 65 per cent—a fair average being 50 per cent—while our power factor in cutting runs from 65 to 90 per cent—a fair average on heavy cutting being 80 per cent. Our demand for the heaviest sort of welding is 5 kw., and our demand for the heaviest cutting is 50 kw. If apparatus were rejected for such power factors, the induction motor would be thrown out, and it is the most widely used piece of electrical apparatus in the world.

"Power factor" is another term that does not exist in reality and is no relative of efficiency. Remember the user pays for kilowatt-hours, and our machine is guaranteed to deposit a pound of metal for less than 2 kw.-hr., and no other machine has as yet equaled this low figure.

The reader will probably ask himself "Why are direct-current machines?" That is the question we are asking, now that we have proved that a pure metallic arc can be used on alternating current directly; but horse cars are inferior to electric cars, yet horse cars were in use in New York City two years ago.

C. J. HOLSLAG,
Electric Arc Cutting & Welding Co.
Newark, N. J.

Readers' Views and Comments

Interconnection at Springfield, Ill.

To the Editor of ELECTRICAL WORLD:

SIR: My attention was called by our superintendent to a misleading article in the issue of the ELECTRICAL WORLD under date of Dec. 21, page 1189, entitled "Will Not Interconnect Springfield (Ill.) Plants." The impression is given that the city had refused to hold a meeting to consider the possible saving which might be made by giving the city's electric load to the private company. This is directly contrary to the facts. The city had been ready and waiting for a meeting so that it might have an opportunity to present its case, and it was because of a letter from the State Fuel Administration, clearly indicating that the city was to be given no opportunity to be heard, that I, as commissioner in charge of the Springfield water, light and power plant, sent a long telegram direct to Dr. Garfield setting forth the situation.

It had been stated by the state fuel administrator that 5000 tons of coal could be saved. In view of the fact that the total coal burned by the city light and power plant for a whole year was only 6361 tons and that there were only three months during the year—namely, December, January and February—during the peak of the heating load, when it would be possible to save any coal by giving the Springfield Gas & Electric Company the city's electric load, it was obvious that the Fuel Administration had been grossly deceived. It was found after careful study by the engineering department of Dr. E. W. Bemis that there would be a total saving of 342 tons during those three months in case the weather was normally cold, and that if the city was permitted to return to the company the same amount of current during the summer months, there would be a saving of 980 tons of coal owing to the greater efficiency of the city plant. The city is now using about 4½ lb. of coal per kilowatt-hour as against the company's 6.2 lb. per kilowatt-hour under its most favorable conditions. The output of the city electric plant is about 3,000,000 kw.-hr. per year, about two-thirds being sold for commercial use and one-third for public light and power. The city now has about 1700 consumers and the gas and electric company about 6000.

Inclosed is a copy of the telegram to Dr. Garfield, which is self-explanatory. Will you kindly print this letter and telegram, to correct the erroneous impression conveyed in the article referred to, and greatly oblige?

WILLIS J. SPAULDING,
Commissioner of Public Property.
Springfield, Ill.

TELEGRAM SENT TO DR. GARFIELD

Relative to situation Springfield, Ill., concerning interconnection municipal light plant with Springfield Gas & Electric Company's plant for transfer of city's electric load to company, wish to advise we are today in receipt of copy of letter from Harold Almert, director of conservation, Chicago, Ill., to A. S. Cobb, director states' conservation, Washington, D. C., in which Almert represents, first, saving from interconnection of between 4000 and 5000 tons of coal; second, that material for connection is on hand and connection easily made within a few days at expense of Springfield Gas & Electric Company; third, that Springfield Gas & Electric Company is charging street-railway company 1.25 cents, which Almert states has been in effect for some time, and that company has asked State Public Utilities Commission for increase to 1.4 cents, which he says is a fair rate; fourth, recommends that the fuel department request city to permit connection and shut down its electric plant on basis of 1.4 cents per kilowatt-hour, "and then let the city decide whether or not they are willing to coöperate and aid the government in this conservation." Considerable correspondence has heretofore been had between city and Almert, in course of which city advised Almert that actual saving would be very slight, and city was promised full hearing at Springfield. Almert's letter to Cobb admits Springfield Gas & Electric Company has presented its side to him, but makes above recommendation without the promised hearing and without opportunity for city to reply to or refute company's statements.

City has employed Dr. Bemis, whose engineering staff has made full investigation and report, copy of which Dr. Bemis will to-day mail to you. Inasmuch as transfer of the city's electric load to company would result in no saving at its combined water and light plant except that of actual cost of fuel consumed for electric current, a rate of 1.4 cents would mean loss to the city of almost $3,000 per month. In addition, street-railway rate is not an old rate but one permitted during war only. Prior to war the rate to street-railway company was less than 1 cent. No shortage in coal now exists or has existed for some weeks in this section. Mines are shutting down for lack of orders. City does not wish to be put in light of refusing coöperation with administration where no need for proposed change exists. Springfield Gas & Electric Company has fought city's plant since inception in every posible way, including elections and court proceedings. Local manager of company made statement in early summer that within four months he would have transferred to his company city's full electric load. We believe Almert being misled by company to further latter's interests in this fight. Are to-day mailing complete copies of correspondence as supplement to Dr. Bemis' report.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SECRETARY LANE ASKS FOR $200,000 FOR POWER SURVEY

Appropriation by Congress Requested for Use by Geological Survey that Country May Obtain "Economical and Dependable Power"

Secretary of the Interior Lane has asked Congress to appropriate $200,000 for use by the Geological Survey in investigating the power supply for the Boston-Washington industrial region. In asking the appropriation he said:

Because conditions are most critical on the north Atlantic seaboard, and because transportation and industry are most congested in that region, an investigation of this territory will lead to the greatest immediate return in fuel economy and transportation efficiency.

As a reconstruction measure it is necessary that a comprehensive plan of power supply for industrial districts be worked out as promptly as possible, so that the country may obtain the advantages of economical and dependable power during the period of international competition to follow.

The matter was referred to the appropriations committee.

STILL NO AGREEMENT ON THE WATER-POWER BILL

Hope in Washington for a Meeting of the House and Senate Conferees, but Many Obstacles to Action Before March 4

Many efforts have been made by the Senate conferees on the water-power bill to reach an agreement with the House conferees, although no hopeful action had been taken in Washington at the time this dispatch was filed. The Washington representative of the ELECTRICAL WORLD reports that the House conferees, who include members of the House committee on interstate and foreign commerce, have been occupied with the hearings concerning the packers. This has been an element which has militated against action on the part of the House conferees. On the other hand, however, Representatives Sims, Ferris and Haugen, three of the House conferees, aside from any other duties which have been occupying their attention recently, have remained firm in their refusal to give in on any of the points involved in the House bill, and, Senators state, they have refused to meet Senate conferees in the conciliatory spirit which the Senators say they are ready to exhibit on their own part.

By the time this is published it is possible that a meeting of the conferees will have been held. There is hope in Washington among those who are looking forward to the possible passage of the water-power bill that a meeting, if not held by the end of this week, will be held around the first of next week.

Representatives Lever, Esch and La Follette are urging action on the part of the conferees which might bring about the passage of the bill. Senator Shields is still absent from Washington, ill at his home in Tennessee, but the acting chairman of the Senate conferees, Senator Bankhead, is quoted as being willing to meet the House conferees more than half way in order to obtain the passage of the bill before March 4.

THE BUSINESS OUTLOOK FOR WHITE-CEDAR POLE INDUSTRY

Slow Readjustment of Values to Follow Similar Change in Prices of Commodities Used by Producers—L. L. Hill President

The twenty-third annual meeting of the Northern White Cedar Association was held at the Hotel Radisson, Minneapolis, Jan. 20, 21 and 22. In the opening address President Gerich said:

"The year 1919 will develop a readjustment of values much greater in some commodities than in others. Our industry should work with cautious optimism, knowing its costs, watching its expenses, and it would seem to me that with a gradual readjustment of values, not only of our own products but of those we use so heavily in producing poles, the cedar industry should have a gratifying peace future of prosperity."

Among the other topics discussed by the various committees and the delegates were the railroad freight rates, insurance, the labor situation and the substitution of metal and other commodities for forest products.

The following officers were elected for the ensuing year: President, L. L. Hill of the Page & Hill Company, Minneapolis; vice-president, L. A. Furlong of the Valentine-Clark Company, Minneapolis; treasurer, W. B. Thomas of Manistique; secretary, H. B. Boucher of Minneapolis; directors, B. Finch of Duluth and M. J. Bell of Minneapolis.

NATIONAL COMMITTEE CLOSES ITS OFFICE IN WASHINGTON

Curtailment of War Activities Eliminates the Necessity of Co-operation with Various Departments of the Federal Government

Deciding to close the Washington office, the National Committee on Gas and Electric Service, of which John W. Lieb is chairman and George W. Elliott secretary, sent this letter to government departments:

The curtailment of all war activities as a result of the signing of the armistice and the gradual relinquishment of direct and indirect supervision by the government of industrial activities incident thereto practically eliminates the necessity of the coöperation which the National Committee on Gas and Electric Service has been rendering to

its various departments. The maintenance of the Washington office of this committee, is, therefore, no longer necessary, and it has been decided to close the office in the Munsey Building, Washington, on Feb. 1, 1919.

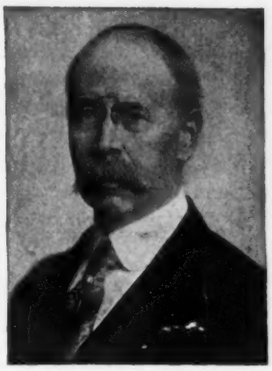
Should there be any service which the committee may be able to render or information which it may be able to furnish to government departments, requests for such information should be directed to the committee's New York headquarters, Fifteenth Street and Irving Place.

We beg to assure you of the committee's hearty appreciation of the opportunity which you have afforded to the gas and electric light and power companies of the country to render service to the government and of its readiness to render any further service that may be desired.

Attitude of Labor in the Readjustment Period

BY J. C. HOBART

President Triumph Electric Company, Cincinnati



THE attitude of labor in the readjustment period is one of the most, if not the most, important problems confronting the country. The statement attributed to Mr. Gompers, representing labor, that "reductions in wages would be resisted to the last trench," and that attributed to Mr. Barr, as a representative of employers, that "the last economic penny must be exacted from wage earners," get us nowhere and may lead to serious trouble if not to anarchy.

Three short years ago the people of this country were regarded by other nations as a nation of money grubbers. In three short years we have acquired a world reputation as a nation of idealists. Recently we have demonstrated our ability as a nation to transform our idealism into successful practice.

Leading statesmen of this and other nations are crediting President Wilson with voicing the sentiments of the great mass of the people of all nations. President Wilson is telling those people that the recent victory for democracy means that we are never going back to conditions that existed before the war. He is promising the peoples of the world greater freedom in the pursuit of life, liberty and happiness, greater opportunity for self-expression, and the peoples of the world are translating these promises to mean something more and something better than they ever had before.

When we pause and remember that the people of this country working for wages represent perhaps five times the voting strength of those paying wages, we cannot escape the conclusion that if these promised conditions are not provided the people of the nation have power to secure them in their own way.

What "labor," what people who work for wages, really gained during the period of the war was an increase in the ratio between wages and the cost of living, and that gain they are going to be very unwilling to relinquish. I don't believe we should wish them to do so. If we were wage earners, we would contend for the same thing—that is, the increase of the ratio of wage to the cost of living. A high ratio means an increased purchasing power, an increased consumption of everything we produce and a happy and contented people. There is nothing apparent in the immediate future to indicate any material reduction in the cost of living.

President Wilson has asked for $100,000,000 for food relief of foreign nations. While this is a small sum in comparison with our other war costs, it represents larger purchases of all food products. It is a necessary expenditure. We cannot see whole peoples starve, but it is not probable that prices of food in this country will decline under these conditions. The demand of foreign nations for raw and finished materials for reconstruction and to build up their industries is greater than the visible surplus supply, and until these demands are satisfied we can expect small reductions from present price levels. Until such reductions take place wage scales should not be reduced.

Serious as is the problem of a high wage rate, I can conceive that many wage earners attach even more importance to their conception of the promise of "a greater opportunity for self-expression." This is generally understood to mean a voice in the determination of the conditions surrounding them in their daily lives and occupations. When we remember that government departments during the war period were insisting that employers holding government orders arrange for their employees to elect their own representatives, when we know that such industrial leaders as Mr. Schwab and Mr. Rockefeller advocate the same principle, and when we remember the overwhelming voting power of the wage earner, we must realize that unless the employers, the men most thoroughly qualified by their intimate knowledge of the problems of industry, come forward and provide the proper machinery to permit this "self-expression," the workers will provide it themselves and many expensive and annoying experiments will result.

I believe the patriotism, the idealism—if it is called such—that under the stress of war actuated employer and wage earner alike, each ready to give his all, ready to make the supreme sacrifice of life itself at his country's call, is as powerful an influence in peace as in war and requires only the proper leadership to make it effective.

Every member of a national industrial organization should carry the message to his local organization—chamber of commerce or whatever it may be—in his home town that the prosperity of the nation depends on the prompt action of the leaders of industry inspired by the same spirit of self-sacrifice that called them to the support of our government in the crisis of war. Industry should coördinate its forces and continue its war-time coöperation with the government in the solution of the problems of peace, and until a national policy is adopted there should be no reduction from present wage levels.

MEETING AT CHICAGO OF ELECTRICAL INSPECTORS

Western Association Has Fourteenth Annual Meeting and Considers Codes and Their Application—C. K. Cregier Elected President

The Western Association of Electrical Inspectors at its fourteenth annual meeting in Chicago on Tuesday, Wednesday and Thursday of this week agreed that the rule applier is doomed. The inspector who has neither the common sense nor the experience to supplement code instructions will be supplanted. Dana Pierce epitomized the general sentiment when he said: "Let us all try to become better engineers while being no less efficient as inspectors."

Frank L. Lucas in his presidential address said that different interests had endeavored to get inspectors to approve sub-standard work on account of conditions which it was claimed had to be met to win the war. Nevertheless, he was glad to report that the code standard had been maintained, and he hoped to see all attempted encroachments in the future meet with the same intelligent resistance as in the past. Some manufacturers, contractors and others think the inspectors should be willing to take a chance. Many inspectors, on the other hand, proscribe everything not proved.

Dana Pierce, chairman electrical committee of the National Fire Protection Association, advised inspectors to look at their problems from both sides and attempt to bring all contenders to a common viewpoint. There is a feeling that the National Electrical Code is being too generally used by inspectors as an inhibitor, when it is in reality a most constructive instrument if applied in the proper spirit. Mere rule appliers cannot do this. Such men look to the rules for information which their own knowledge and experience should supply. When they do not find an answer to the problem in the code these rule appliers too often condemn what any one with horse sense and a knowledge of common engineering principles would pass. Mr. Pierce thought the solution lay in the development of inspectors along engineering lines.

Charles W. Babcock, assistant city attorney of Milwaukee, Wis., said city ordinances must be reasonable and in accordance with accepted practices in the business to stand the test in court. His advice to any one wishing to draw up a valid ordinance was: "Don't be too greedy and don't be too specific as to detail."

A paper was read by J. B. MacNeil, electrical engineer for the Westinghouse Electric & Manufacturing Company, on "The Economy of Small-Capacity Circuit Breakers." He reviewed the whole field of circuit-breaker applications and explained where and why each type could be used to the best advantage.

The gain to the industry by necessary standardization effected during the war was dwelt upon by W. H. Merrill, president of the Underwriters' Laboratories, and F. S. Wilhoit, Cutler-Hammer Manufacturing Company. A few examples were given of what was done to reduce to a minimum the number of styles, sizes and types of apparatus during the war. For instance, authority was given to cable manufacturers to use B. & S. gage wires in stranded cable instead of drawing special sizes of wire to make the number of circular mils a round figure.

The manufacturers have benefited by the changes no less than the users, and there is every indication that standardization will spread to other lines, notably motors. Since the armistice was signed makers of panelboards have increased the single war-time standard to two standards because the Eastern States specify the war standard requirement of line switches without fuses, but in the West they insist that fuses be furnished.

The Bureau of Standards has as an experiment combined its Electrical Safety Code with the National Electrical Code. Dr. Morton G. Lloyd, electrical engineer for the bureau, explained the scope of the combined work and asked if the association wanted the bureau to print it. The inspectors thought this would imply an indorsement which it was not desired to give at this time. The motion to recommend the publishing of the combined code was consequently voted down.

Dana Pierce voiced the majority opinion when he said that it would be a fine thing to have a combined code for the protection of both person and property. It would be best, however, to keep the safety code separate until it can be developed in sufficient detail to permit its enforcement and until plans are perfected for its proper administration. Under present conditions no provision has been made for changing the safety rules as occasion demands.

It was also felt that approved apparatus under the combined code would come to mean approved from both fire and safety standards, whereas safety in operation depends more on the manner and place of installation than on the apparatus itself. F. A. Barron, engineer for the General Electric Company, discussed devices to protect the windings of small motors which are thrown across the line at starting.

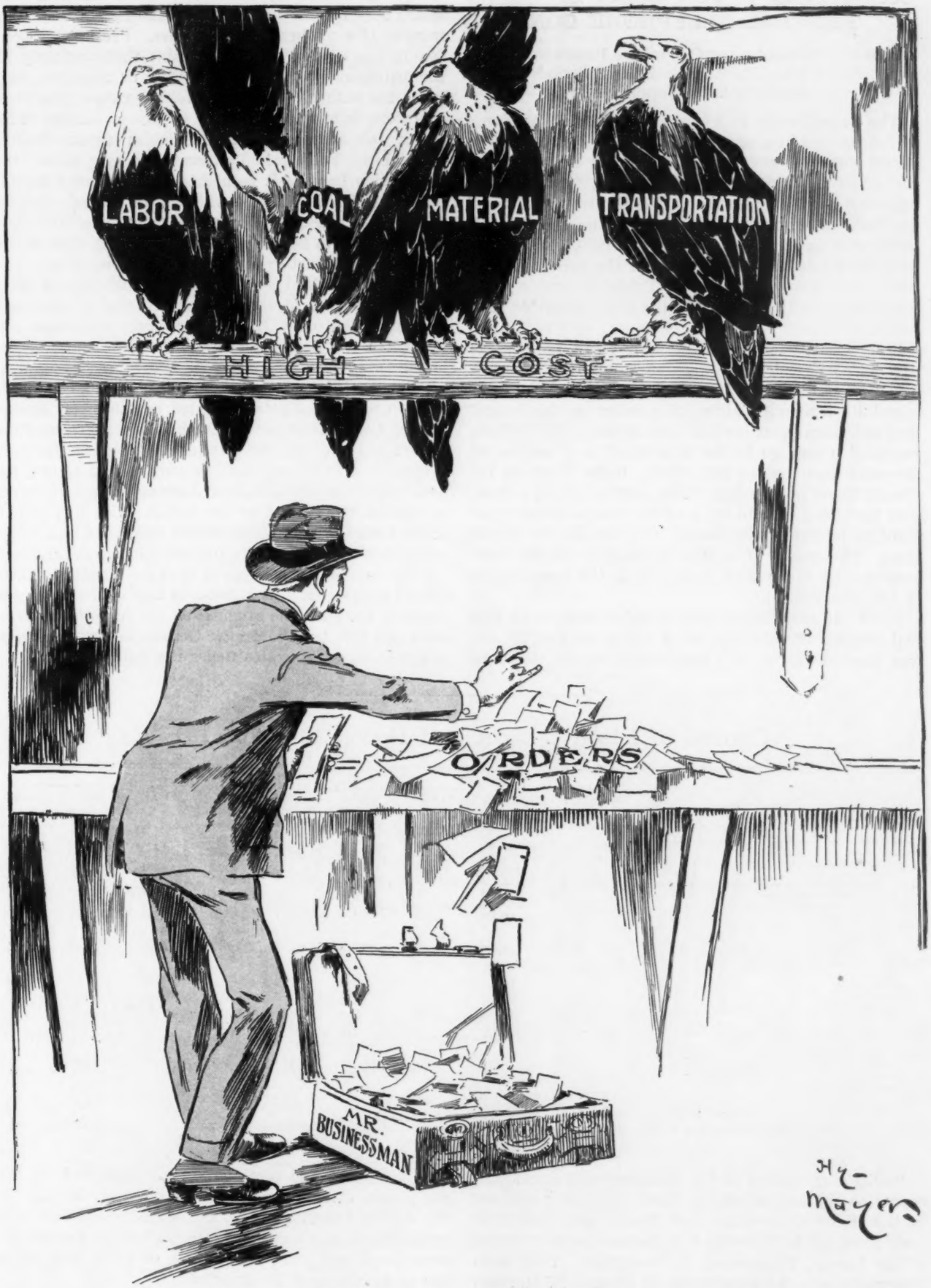
The discussion of the report of the association committee on the National Electrical Code brought out the fact that in this country about a hundred fires are reported as being caused by heating appliances every day. This is the main reason why the annual fire loss due to electrical causes is $16,000,000. A resolution was passed recommending a change in the code rule to require an insulating bushing instead of the present metal bushing where flexible cords pass through the metal covers of outlet boxes. No one present had experienced in practice any trouble with the metal bushings, and the change was recommended on purely theoretical grounds.

The committee on installation and operation of induction motors compiled some useful tables of wire and fuse sizes required by the code for induction motors. Tables and formulas were developed by the committee on rubber-covered wire which gave the size of conduit required for any number of wires of the same or different gage.

D. W. Elyson, engineer for the General Electric Company, read R. A. Barron's paper on the construction features of automatic railway substations.

One entire session was given up to a discussion of the very many problems of the electrical inspector.

The officers for the ensuing year are: C. K. Cregier, Chicago, president; K. W. Atkins, Kansas City, first vice-president; O. M. Frykman, Minneapolis, second vice-president, and W. S. Boyd, Chicago, secretary-treasurer.



"If they'll come down a perch, they'll get these orders!"

COMMITTEE IS FOR LIMIT ON FEDERAL TELEPHONE CONTROL

House of Representatives Committee Passes Resolution Fixing Dec. 31, 1919, as End of Period—Action of State Commissions

The committee on post offices and roads of the House of Representatives, after a hearing, voted on Jan. 28 to report a resolution extending the period of government control of the wire systems to Dec. 31, 1919. This is regarded as a compromise. The Postmaster-General had testified before the committee that he would be satisfied with an extension to Dec. 31, 1920, and various committee members had urged that the period be limited to from three to six months. Public ownership provisions were wholly discarded in the final committee resolution.

State commissions are continuing their fight on the new telephone rates, and varying results are reported. The United States District Court at Indianapolis dissolved its temporary restraining order on the ground that no federal question had been raised. The Indiana commission may go to the state court as a number of the other commissions are doing. Judge Wiest in the Circuit Court at Lansing, Mich., issuing an injunction, held that Congress did not give the federal government right to interfere with lawful rate regulations of the state. The power of a state to regulate its domestic concerns, he declared, is essential to the preservation of local government.

The California Railroad Commission hearing on federal revision of telephone rates began on Jan. 25 and was concluded Jan. 27. Representatives of telephone companies and of the Attorney-General admitted they would obey federal orders rather than those of the commission if a conflict on rates arises. President Edgerton in his citation made the point that obviously all complaints and petitions from utility or consumer must go to the authority which establishes rates. The case, therefore, is considered vitally important because it involves the issue of state regulation versus federal ownership. Feeling in California strongly favors the commission because it regulates after thorough examination of local conditions, whereas the federal increase of rates has been arbitrary and without opportunity for the consumer to be heard. A bill has been filed in the United States court by the California commission.

The New England company inaugurated the new rates Tuesday in spite of the suspension order of the commission. Chairman Macleod promptly requested Attorney-General Atwill to apply to the Massachusetts Supreme Court to compel the company to suspend the rates, whether by injunction or mandamus. In his communication Chairman Macleod pointed out that the resolution of Congress under which the telephone properties were taken over by the President "provided, further, that nothing in this act shall be construed to amend, repeal, impair or affect existing laws or powers of states in relation to taxation or the lawful police regulations of the several states, except where such laws, powers or regulations may affect the transmission of government communications or the issue of stocks and bonds by such system or systems." It is believed that under the police power of the state the commission has jurisdiction over rates and that the Postmaster-General has no authority to revise intrastate rates under the federal statute.

Census of Electric Light and Power Stations, 1917

	Utah			New Mexico			Nevada		
	1917	1912	1907	1917	1912	1907	1917	1912	1907
Number of establishments	47	45	31	29	21	15	14	8	9
Commercial	25	28	22	25	18	15	13	7	9
Municipal	22	17	9	4	3	...	1	1	...
Income	$5,444,807	$1,549,265	$665,241	$894,207	$497,895	$292,682.	$938,929	$618,942	$372,108
Electric service	$4,965,930	$1,530,060	$627,332	$874,317	$488,422	$289,962	$833,088	$607,597	$352,959
All other	$478,877	$19,205	$37,909	$19,890	$9,473	$2,720	$105,841	$11,345	$19,149
Total expelses, including salaries and wages	$4,018,963	$1,206,729	$461,675	$844,575	$449,516	$226,937	$662,359	$428,255	$245,291
Number of persons employed	1,215	401	198	256	158	83	190	147	78
Salaries and wages	$937,869	$365,399	$159,686	$223,510	$119,088	$66,981	$144,012	$113,636	$77,264
Total horsepower	226,595	60,588	35,950	17,108	11,015	4,548	16,832	15,420	6,980
Steam engines:									
Number	15	6	10	37	32	26	5	6	4
Horsepower	34,189	1,000	1,279	13,226	8,428	4,035	1,100	2,210	235
Internal-combustion engines:									
Number	..	..	..	22	9	..	8	8	6
Horsepower	..	..	..	3,252	1,770	..	617	670	485
Waterwheels:									
Number	112	63	45	7	9	6	21	13	9
Horsepower	192,406	59,588	34,671	630	817	513	15,115	12,540	6,260
Kilowatt capacity of dynamos	147,359	37,935	33,592	12,713	7,981	3,789	12,353	10,513	5,690
Output of stations, kw.-hr	466,995,136	86,634,658	61,672,661	17,244,768	9,027,824	4,614,349	53,846,178	44,969,772	29,621,730
Stationary motors served:									
Number	1,046	1,044	406	729	639	195	970	553	411
Horsepower	126,555	37,490	5,519	7,626	4,084	1,231	15,874	12,384	6,850
Number of street lamps:									
Arc	2,638	321	*	13	247	*	14	204	*
Incandescent, etc	7,697	5,237	*	2,288	627	*	1,003	401	*

* Not available.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the states of Nevada, New Mexico and Utah have been given out by Director S. L. Rogers, of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of Eugene F. Hartley, chief statistician for manufacturers.

The statistics relate to the years ended Dec. 31, 1917, 1912, and 1907, and cover both commercial and municipal plants. They do not, however, cover electric plants operated by factories, hotels, etc., which generate energy for their own consumption, those operated by the federal government and state institutions or those that were idle or in course of construction.

The figures are shown in detail in the accompanying table.

FULL RESUMPTION OF DETROIT PEACE INDUSTRIES CERTAIN

Alex Dow Says He Will Make No New Departure Until Uncertainties Peculiarly the Result of War Are Disposed Of

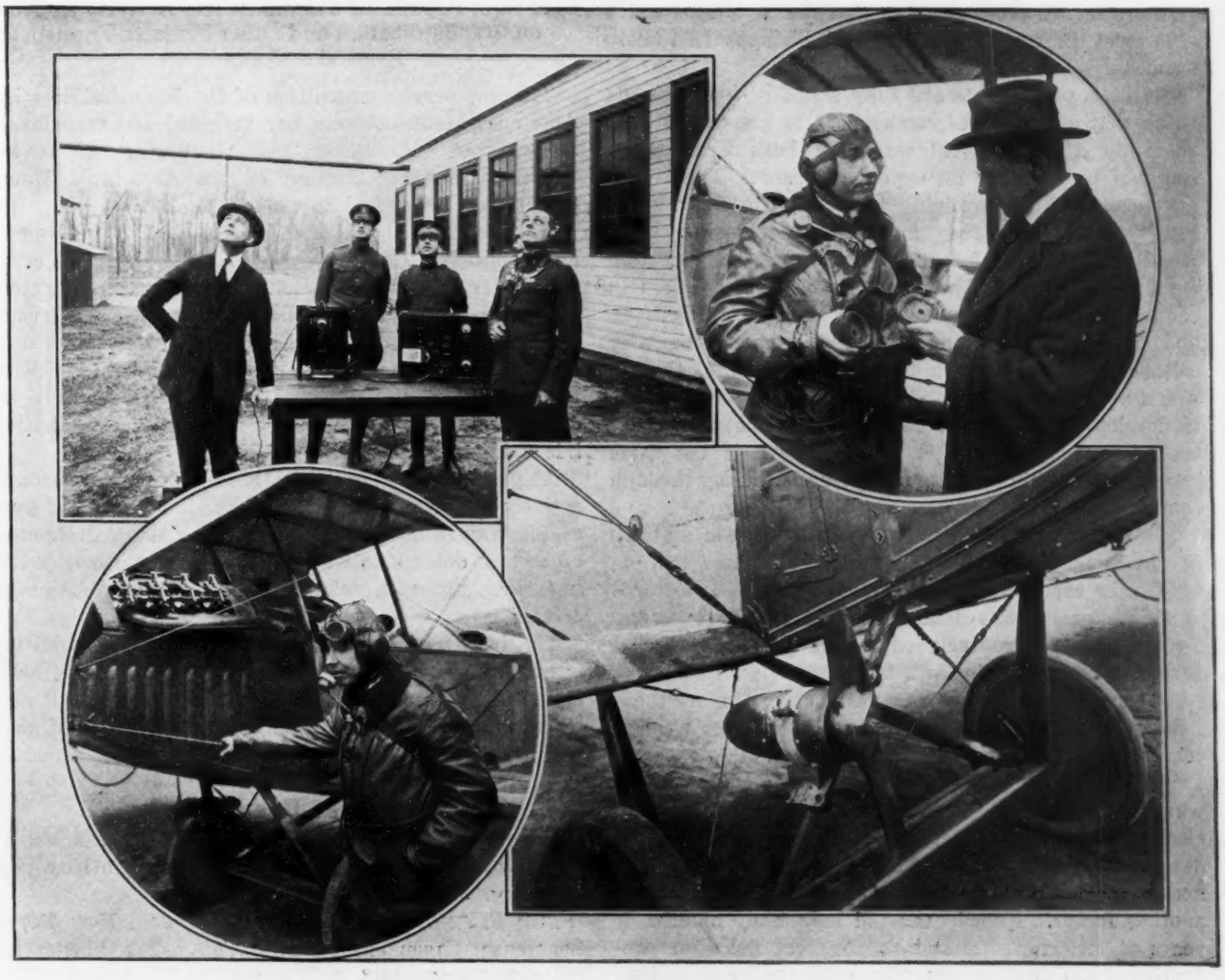
In his annual report to stockholders President Alex Dow of the Detroit Edison Company touches on operating ratio, construction requirements and the outlook. He says on these points:

The operating ratio is still too high, 67.2 per cent as compared with 63.8 per cent in 1917 and 54.5 per cent in 1916. The cost of coal is, of course, the chief cause of the excess; but all wage rates continued to increase during the year, and we are to-day paying the highest hourly, weekly and yearly rates that we have ever paid; and tax requirements also are large. Further, to our loss, the quality of the available coal has not been up to standard, and the necessity of accumulating during the summer a large reserve stock had made an abnormal expense for handling coal into and out of stock piles.

At the present time we have on hand or in process of delivery much equipment, ordered in 1915 and 1916, and at the relatively low prices of these years, the delivery of which was delayed by precedence given to war work. Among this material are turbines and boilers for the St. Clair River plant, which was to have been constructed in 1917 and on which we may begin work during 1919, and some of the material for a 30,000-kw. addition to our Delray power plant, which addition will be proceeded with at once. We have, however, avoided committing the company to any general construction program for 1919. We have no doubt that increased capacity will soon be required and are clear that certain expenditures must be made; but costs of work done in the next few months are sure to be abnormally high, and, on the other hand, the expected demands of our public for more service may be delayed by any one of a score of possible happenings.

Full resumption of the peace industries of the territory which we serve is certain. The doubt is as to the duration of the period of readjustment. Local opinion is that the restoration of normal activities in that territory will be rapid and that in the meantime there will be no serious disturbances of industry, trade or finance. We are, nevertheless, proceeding with special caution, and will make no new departure until those uncertainties which are peculiarly the result of the war shall have been disposed of.

The Wireless Telephone in Airplane Service



The Western Electric Company has made public some facts in regard to the use of the wireless telephone in army airplanes. It was a problem to exclude the noise of the engine and the air. A wind-driven generator was used to supply electrical energy to vacuum tubes. The photographs tell part of the story.

FAVORS COMBINATIONS TO TEST EXPORT TRADE

Pierce C. Williams, United States Commercial Attache in Paris, Points Out Desirability of Their Formation by Electrical Manufacturers

Pierce C. Williams, commercial attaché in Paris of the Bureau of Foreign and Domestic Commerce, Department of Commerce, has just returned from France and was in New York for a short time before going to Washington. The commercial investigations made by Mr. Williams in France had to do with the general problem of industrial reconstitution, but his observations brought out several points which apply specially to the electrical industry, and these were discussed by him in an interview with a representative of the ELECTRICAL WORLD.

Mr. Williams expressed the opinion that wherever practicable it would be desirable for smaller manufacturers in the electrical industry to form combinations for export purposes under the provisions of the Webb-Pomerene act. "My own feeling," he said, "is that this is not the time for a small individual manufacturer to spend money in sending a representative to France. Buyers there now will get only the goods they need to have. In three or four months the situation may be more settled everywhere so that the conditions which will exist in export markets can be appraised more accurately.

"If lines of products are fully standardized, I should think that a number of competitors or non-competitors could do a very useful work for both France and Belgium by forming an export company. They could go ahead without involving themselves in much overhead expense until they find what the market would absorb in volume of trade. There will be a certain amount of collective buying in France and Belgium in connection with reconstruction of damaged industries, and that means an opportunity to experiment with collective selling. I am convinced, however, that it would be a mistake for each manufacturer to undertake to develop markets individually and to commit himself to the expenses that this would involve if the same results can be obtained at a much smaller outlay through combination."

Mr. Williams said that the central electric stations in the invaded districts of northern Frtnce had an aggregate capacity of 300,000 kw. About two-thirds of this capacity was destroyed. He said that several large questions are included in the problem of what form the reconstruction will take.

"Much of the industrial destruction in northern France," said Mr. Williams, "has been offset by new construction in central France. Cities in other parts of France have grown enormously. The question of whether France will want to industrialize communities will have to be settled with recognition of the development of other sections during the war. The heavy damage done to coal mines by the Germans is another factor. Nobody can tell how many months or years it will take to restore the coal fields to productiveness, but it is generally estimated that a long time will be required. The delay in operation of the coal mines will probably affect the restoration of the power stations.

"If a manufacturer here is looking to France for much business to tide him over, I am afraid he is looking in vain because the business is not there now. I think that perhaps there may be a demand for small supplies in the next few months, but the question of whether our manufacturers do much may depend upon their merchandising methods, their prices and their ability to finance their customers by extending them credit. Later there will be more business, but France will supply everything she can through her own factories to meet her own needs."

Mr. Williams added that two of the French electrical manufacturing companies were in the invaded districts and their plants were virtually destroyed. He said that there would be strong competition from the Swiss electrical manufacturing companies for the French business.

Mr. Williams expects to remain in the United States for two months to discuss French and Belgian trade questions with manufacturers interested. His headquarters will be at the Bureau of Foreign and Domestic Commerce, 734 Custom House, New York.

HEATING DEVICE STANDARDS UNDER CONSIDERATION

Section of Associated Manufacturers Actively at Work on Standardization and Other Projects Through Particular Committees

The war service committee of the Electrical Heating Appliance Manufacturers has resigned and transferred its work of coördination and standardization to the Heating Appliance Section of the Associated Manufacturers of Electrical Supplies.

This section, of which F. D. Goode, Cutler-Hammer Manufacturing Company, is chairman, is considering the matter of standardization through three committees according to product as follows: Domestic appliances, Robert Kuhn, American Electrical Heater Company, Detroit, chairman; ranges, George H. Hughes, Edison Electric Appliance Company, Chicago, chairman, and industrial heating appliances, H. Fulwider, General Electric Company, chairman.

At present the standardization of plugs and cords is actively under consideration. Also, the order last year of the War Industries Board stopping the manufacture of certain devices and the curtailment of others is being taken up, with relation to the standardization of certain types and sizes in order to minimize stock.

The industrial heating device committee in addition is making a study of the possible uses of electric heat. Efforts will be made not only to widen its use but also to raise effectual guards against the wrong use of electric heat.

Books Received

STORING: ITS ECONOMIC ASPECTS AND PROPER METHODS. By H. B. Twyford. New York: D. Van Nostrand Company. 200 pages, 96 illustrations.

THE FLYING BOOK. By W. L. Wade. New York: Longmans, Green & Company. 275 pages, illustrated. Price, $1.75 net.

GRAPHICAL AND MECHANICAL COMPUTATION. By Joseph Lipka. New York: John Wiley & Sons, Inc. 264 pages, 110 illustrations. Price, $4 net.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 255 of this number.

A. I. E. E., Denver Section.—"The Future of the Public Utilities as Affected by the War" was the topic of Franklin P. Wood, who addressed the Denver Section of the American Institute of Electrical Engineers on Jan. 18.

A. I. E. E., Lynn Section.—On Jan. 22 Rear Admiral John R. Edwards, U. S. N., retired, delivered an address before the Lynn Section of the American Institute of Electrical Engineers on "Industrial Features of the Modern Navy."

A. I. E. E., Cleveland Section.—A. H. Rudd, signal engineer of the Pennsylvania System, Philadelphia, had railway signaling systems for his subject at the Jan. 20 meeting of the Cleveland Section of the American Institute of Electrical Engineers.

Institute of Radio Engineers.—A paper on "The Uni-Control Receiver" will be presented by Roy E. Thompson at the meeting of the Institute of Radio Engineers to be held on the evening of Feb. 5 in the Engineering Societies Building, New York City.

San Francisco Electrical Development League.—At the regular Monday luncheon on Jan. 20 the league was addressed by John A. Britton and C. P. Cutten, the subject being relations between public utility commissions, public utilities and consumers.

Pittsburgh Section, A. I. E. E.—At the Jan. 14 meeting of the Pittsburgh Section of the American Institute of Electrical Engineers W. R. Work was reëlected chairman and J. W. Welsh, special engineer of the American Electric Railway Association, spoke on "Passenger Transportation Problems During the War."

A. I. E. E., Spokane Section.—The Spokane Section of the American Institute of Electrical Engineers met jointly with the American Institute of Mining Engineers, the American Society of Civil Engineers and the Spokane Engineering and Technical Association on Jan. 17 to hear J. C. Ralston speak on "The Big Bend Irrigation Project."

Oklahoma Utilities Association.—The program for the Oklahoma Utilities Association convention to be held in Oklahoma City on Feb. 13, 14 and 15 will include an address by J. B. A. Robertson, Governor of Oklahoma. W. D. Humphrey, chairman of the Corporation Commission, will speak on "The Relation of the Corporation Commission and Public Utilities," and others will also be heard. Limited space will be available for exhibition purposes, and for this there will be no charge. J. O. Kammerman, 611 State National Bank Building, Oklahoma City, may be addressed by those interested.

Electrical Industry Organized at Duluth.—On Jan. 16 the electrical contractors and dealers of Duluth, Minn. were guests of the Duluth Edison Electric Company at a dinner served at the Commercial Club. The purpose of the meeting was to bring out the possibilities for the sale of electrical appliances and to create more cordial relations between all concerns engaged in the electrical business. To put this work on a permanent basis an organization representative of the industry was formed. Its officers are: President, George Brown, Western Electric Company; vice-president, W. M. Hogan, Northern Electric Company, and secretary-treasurer, W. S. Heald, Duluth Edison Electric Company. A committee of three was appointed to outline a definite plan of action for the interests in the industry. A monthly dinner meeting will be held each month.

New York Electrical Society.—An interested audience at the meeting of the New York Electrical Society Jan. 27 listened to Arthur J. Baldwin, vice-president of the McGraw-Hill Company, tell of his recent observations on the battlefields of France. Having visited Europe as a member of a delegation specially invited by the British government, the speaker was able to describe many sights that have not been pictured or described before. Lantern slides were employed to illustrate the devastation wrought by the Germans. Mr. Baldwin referred to the warm feeling that England as a whole has for America, saying that old prejudices no longer exist. He emphasized the point that the great lesson of the war should be that peoples are interdependent and not independent. If this principle is not recognized, Mr. Baldwin said, the battles will have been fought in vain.

American Association of Engineers, St. Louis Chapter.—On Jan. 18 the American Association of Engineers installed a chapter of 150 members at St. Louis, Mo. Addresses on the relation of the engineer to society were delivered by H. W. Clausen, vice-president of the American Association of Engineers; Prof. E. J. McCaustland, University of Missouri; C. E. Drayer, secretary of the American Association of Engineers, and Baxter Brown, president of the Engineers' Club of St. Louis. The new St. Louis chapter has urged the local Chamber of Commerce to form an engineering committee to report on civic questions involving engineering practice. The officers of the chapter are: President, L. Winship; vice-president, F. L. Flynt; second vice-president, C. G. Harrington; secretary, R. B. Kerr; assistant secretary, George Crimm, Jr.; treasurer, C. P. Calvert; directors, J. F. Peters, W. E. Playter, E. F. Collins, E. J. McCaustland, L. T. Maenner and H. L. Hopper.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Rates in California.—The Amador Electric Light & Power Company has been granted by the California Railroad Commission authority to increase its rates, the order being based on the company's showing of costs of power and service and the loss of business due to war conditions. The depression in the mining business in Amador County resulted in a 10 per cent reduction in the number of the company's domestic consumers and more than 15 per cent in the quantity of energy sold in its domestic service during the last two years. It is estimated that the new rates will provide the company with an operating revenue of $39,472. The estimated operating expenses are $24,530, making available for depreciation and return $14,942. The estimated annual depreciation is $4,500, leaving net available for return $10,442. The commission's engineers have fixed the reproduction value of the plant at $150,997. On this sum plus $3,800 working capital the new rates will yield a return of 6.8 per cent.

Rate Increases Authorized in California.—In an opinion written by Commissioner Edwin O. Edgerton, the California Railroad Commission has granted to the Southern Sierras Power Company and the Holton Power Company authority to increase rates by the addition of surcharges, the commission holding that the companies, because of the great increase in the cost of material, labor and supplies, are entitled to a fair return upon their investment and also entitled to sufficient revenue to enable them to carry out necessary betterments and extensions. The Southern Sierras Power Company operates hydroelectric plants in Mono and Inyo Counties. The Holton company distributes electric energy throughout the Imperial Valley. Because both companies are owned and controlled by the Nevada-California Electric Corporation the commission considered the applications as one. Investigation by the commission showed that the excess in cost of operation for 1918 over 1915 totaled $307,518.01, or 69.43 per cent. The gross earnings in 1918 were $1,364,018, with expenses of $856,590, leaving $507,428, or 6.95 per cent, for interest and depreciation. Giving prominence to the fact that the service of the utilities is absolutely necessary, the commission held that the applicants' net for depreciation and return, based upon the 1918 conditions, should be increased to an amount of $700,000 and fixed upon $150,000 as a reasonable annuity for the combined properties.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Members of New York Reconstruction Commission.—Among the members of the Reconstruction Commission appointed by Governor Smith of New York are Charles P. Steinmetz, General Electric Company, and Arthur Williams, New York Edison Company.

Equipping Disabled Men for Usefulness.—A committee consisting of Ralph Elsman, C. E. Morrison and J. C. Robinson was appointed at a recent meeting of the executive committee of the Empire State Gas & Electric Association to consider the suggestion that the association assist in the institution of educational courses in connection with the work of the Red Cross Institute for the Rehabilitation of Disabled Men or similar organizations to equip disabled men for positions in the gas and electric industry.

Proposed Bond Issue in California.—Declaring that the opportunity to sell its bonds is more favorable now than for some time past, the Western States Gas & Electric Company has applied to the California Railroad Commission for an order authorizing the issue of 5 per cent bonds of the face value of $450,000. The petitioner believes that it can sell the bonds at not less than 82½ plus accrued interest. The proceeds are to be used to reimburse the company for construction expenditures already made and to provide funds to carry out a construction program planned for 1919.

Cleveland Municipal Plant Operations.—Commissioner of Light W. E. Davis of Cleveland, Ohio, has not only promised service to a great number of domestic users this year, but has guaranteed that the rate will remain at 3 cents, notwithstanding the increased cost of coal, labor and materials for the extension to the plant, which is costing about $2,500,000. Mr. Davis said that it is possible to maintain the low rate because the industries are using about 68 per cent of the plant's output. He said that this makes it possible to operate the plant twenty-four hours a day, with small wear on the apparatus, and the substantial profit will overcome the loss on domestic business. Of the $2,500,000 to be used in the extension of the plant, he said that about $500,000 will go to the construction of line extensions to domestic consumers, and this will add about 5000 to the list of 20,000. Through the past year the plant furnished service for war industries largely, and it was not possible to add to the number of domestic consumers.

Heating Hearing in Idaho.—For almost two weeks the Idaho Public Utilities Commission took testimony on the subject of open-air heating by electricity to determine whether or not it was feasible. The commission has not yet submitted its findings. Forty-three hydroelectric companies were cited to appear and give testimony. Most of them did so. Their testimony was to the effect that open-air heating by electricity is not practicable.

"Service Bureau" of San Francisco Engineering Societies.—In San Francisco there has recently been established an "Engineers' Service Bureau" which is intended to serve as a clearing house (1) through which engineers in search of employment may get in touch with prospective employers and (2) through which employers may find technical men promptly as they are needed. The bureau is being conducted at the San Francisco Engineers' Club through the Joint Council of San Francisco engineering societies. In this organization are represented local sections of the American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Society of Mining Engineers and American Chemical Society.

United States Naval School of Engineering Is Established at Pittsburgh "Tech."—The arrival in Pittsburgh recently of a detachment of naval officers marks the establishment by the government of a United States naval school of turbine engineering at the Carnegie Institute of Technology. These officers have been in every instance chief engineers of ocean tramp steamers with experience in the operation of reciprocating steam engines. They have been detailed to the institute to learn the principles and operation of engines of the turbine type, for service in the near future on the ships of the new merchant marine. The course of instruction is under the joint direction of officers sent by the Navy Department and of members of the faculty of the institute.

Seeks Control by Public Utility Commission.—The Kansas Gas & Electric Company is preparing a bill to be presented to the Kansas Legislature asking that it be placed under the Public Utility Commission and that all existing charters in its twenty cities and towns be revoked. The Kansas franchises terminate at various times, causing endless confusion in the general business. The bill provides that, while the company shall not be relieved from any of the obligations imposed upon it by these franchises, it shall not be required to plan its business upon the supposition that such franchises will terminate at certain dates, but shall continue so long as satisfactory service is rendered. According to the present law no franchise may be granted any corporation for a longer period than twenty years. The Kansas Gas & Electric Company contemplates expending $12,000,000.

Suggests Colleges Coöperate in Commission Work.—Gov. John H. Bartlett of New Hampshire says regarding the Public Service Commission in his message to the Legislature: "This commission has been a necessity and is still useful and beneficial. The railroad situation is going through an evolutionary period and no one can say now what may later be easy to decide with reference to this commission. It could gradually be reduced to one member in a state of this size, and its expenses reduced by supervision and by possible coöperation by our colleges in the scientific work."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability for Maintaining Pole in School Yard.—Those responsible for maintaining within a school yard a pole carrying electric wires are held not liable in the Maryland case of Grube versus Baltimore for injury to a bright boy, ten or eleven years old, who, knowing that climbing the pole was not permitted, reached the climbing spikes from a fence and ascended the pole until he came in contact with a wire, which burned him and caused him to fall, to his injury (L. R. A. 1918 E. 1036).

Line of Road in Establishing Transmission Line.—When the landowner in planting trees and erecting fences along the line of a public highway incloses and retains the possession and uses of a part of the land lying within 33 ft. of the section line, a corporation undertaking the erection of an electric transmission line along the road under the privilege granted to it by law may assume the line of such road to be where such trees and fences are found until the line is otherwise definitely fixed and established, the Supreme Court of Nebraska held in Saline County versus Blue River Power Company (169 N. W. 785). Defendant undertook the construction of an electric transmission line along a public highway. The statute then in force provided: "Whenever practicable the poles shall be set upon the line of such highways." By the terms of an injunction order entered by the district court defendant was required to set its poles "upon the line of such highways." An appeal was prosecuted to this court. While the appeal was pending the statute was amended to read: "Whenever practicable the poles or towers shall be set in such highway and adjacent to and not more than six feet distant from the line thereof." Held, that the statute in force at the time of entering the judgment in this court will control.

Judge James H. Reed has resigned as president of the Philadelphia Company, Pittsburgh, Pa., which controls the Duquesne Light Company, Pittsburgh Railways and other properties. He will remain as chairman of the executive committee and vice-president, and will retain a more or less active connection with the company.

James D. Callery, who has been president of the Duquesne Light Company, Pittsburgh, Pa., succeeds Judge James H. Reed as chairman of the board of the parent company, the Philadelphia Company.

Arthur W. Thompson, vice-president of the Baltimore & Ohio Railroad and a federal director of railroads, has been elected to succeed Judge James H. Reed as president of the Philadelphia Company and to succeed James D. Callery as president of the subsidiary, the Duquesne Light Company, Pittsburgh, Pa.

M. O. LEIGHTON

M. O. Leighton, consulting engineer of Washington, D. C., has been chosen as chairman of the newly formed national service committee of the Engineering Council. Mr. Leighton, who has made a particular study of the hydroelectric development of this country, was one of those who testified before the congressional committee on the possible commercial development of navigable rivers and streams in forest preserves, indicating also to what extent canalization of navigable streams would result in improvements to navigation as well as in water-power possibilities. He has made a study of the application of water power to many uses, including industry, central stations, electrochemistry, and especially railroad electrification. Mr. Leighton was born in 1874. He was graduated from the Massachusetts Institute of Technology in 1896. He engaged chiefly in hydraulic work and in 1906 was appointed chief hydrographer of the Geological Survey. He continued in this work until 1913, when he took up consulting work. He has been a member of a number of government commissions to study waterways and hydraulic possibilities.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

John W. Graham, president of the Idaho Public Utilities Commission, has declined reappointment in order that he may engage in banking.

M. J. Musser, who is employed by the Central Illinois Public Service Company, has been transferred from Mattoon to Beardstown as district manager.

H. E. North, formerly with the Minneapolis General Electric Company, has been appointed manager of the contract department of the Oklahoma Gas & Electric Company, Oklahoma City.

James H. Class, formerly superintendent of the municipal light plant and waterworks, Ogallala, Neb., has been connected with the Intermountain Railway, Light & Power Company, Denver, Col., as manager of its property at Holdredge, Neb.

George W. Elliott, secretary of the National Committee on Gas and Electric Service, who has been seriously ill in a hospital in New York during the last few weeks, is now, his many friends will be glad to learn, on the road to complete recovery.

Walter F. Crossley, formerly general superintendent of the Cairo (Ill.) Railway & Light System, part of the Illinois Traction System, has been transferred to Springfield, Ill., where he will be engaged as a special representative for the Illinois Traction System.

D. L. Wishon, who for the last fifteen years has been civil engineer in charge of reconnaissance work for the San Joaquin Light & Power Corporation, has been appointed to succeed E. D. Farrow, Jr., resigned, as general agent and manager of the Bakersfield (Cal.) district.

J. Paul Clayton, who has been associated with the Middle West Utilities Company, Chicago, has been elected a vice-president of the Central Illinois Public Service Company and has moved to Mattoon, Ill. Mr. Clayton in 1917 went from Mattoon, where he was contract agent for the Central Illinois company, to take charge of the commercial department of the Middle West Utilities Company.

Homer C. Bender has been appointed superintendent of public utilities of Spokane, Wash., a new position. He will be engaged in making personal investigations, gathering data, inspecting utility work under way and in preparing for rate and other hearings before the Public Service Commission. Mr. Bender is a graduate of the Massachusetts Institute of Technology and was for four years connected with Stone & Webster in hydroelectric work.

Major Samuel W. Greenland has received his honorable discharge from the chemical warfare section of the United States Army and has returned to take up his duties as general manager of the Fort Wayne & Northern Indiana Traction Company. During his absence from the utility, Major Greenland has been supervising the erection of a 20,000-kw. steam-driven generating station and a rotary station of the same capacity at the Edgewood (Md.) Arsenal. He also looked after the operation of the utilities at Edgewood.

Milton H. Wagner, transmission engineer of the Dayton Power & Light Company, who resigned on Nov. 1 last to become connected with the United States Fuel Administration at Washington, was transferred on Dec. 16 to the Department of Commerce with the Bureau of Standards, with the title of electrical engineer. His work will be

M. H. WAGNER

principally in connection with the National Electrical Safety Code. Mr. Wagner is a graduate of electrical engineering of the University of Cincinnati. In 1909 he became connected with the Dayton Power & Light Company. He was the first chairman of the transmission and distribution committee of the Ohio Electric Light Association and continued in that capacity for six years. He is also a member of the technical section of the National Electric Light Association and a member of the sub-committee on overhead lines. He has been chairman of the Dayton Power & Light Company section of the National Electric Light Association and while serving in that capacity organized all of the various activities of the company under one organization, which became known as the Dayton Power & Light Welfare Association of the N. E. L. A.

Obituary

John H. Greer, president and treasurer of the Fisher-Chase Manufacturing Company, Columbus, Ohio, manufacturer of fuse and disconnecting switches, died recently of pneumonia.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

PREVAILING CONDITION IN COPPER-WIRE MARKET

New Standards for Rubber-Covered Conductors Provide for Discontinuing Some Small Sizes and Easier Manufacture of Circular-Mil Sizes

January is hardly the time of year to look for heavy buying in the wire market. While the month has provided few orders of a large size, it has created a market for small amounts in many instances. Only absolutely necessary extensions have been made, but considerable maintenance and repair work has been carried into effect.

With the departure last week of the committee of copper producers for Europe, the price of copper will probably hold rather steady until word from them is received. Since the price of wire depends largely on the price of the base copper, as soon as the large buyers have decided that the bottom level has been approximately reached, the larger orders may be expected to come in. The price of copper in most cases has been on a 23-cent base, but one case is known where it has been as high as 27. Some of the smaller producers have been selling as low as the 20-cent base, but it is probable that as soon as their stock becomes pretty well depleted they will raise their price somewhat. Quotations in the open market this week went below 20 cents for spot shipments of electrolytic. Little copper is being sold to the wire manufacturers, as their stocks as a rule are ample for current production and at the prevailing price.

There have been many inquiries received by the larger wire producers for quotations on large orders. One manufacturer has a standing order which is to take effect when he, the manufacturer, is satisfied that copper has become satisfactorily low and stable.

Some inquiries on bare trolley wire have come from South American countries. In the South the month of February should begin to show an increase, but throughout the country generally buying in any large amounts will probably not be felt before March and April. Where in season there would be found an order for 30 or 40 miles of trolley wire, there is now found nearer 2 or 3 miles.

There have likewise been inquiries for copper-clad trolley wire for both foreign and domestic use. Until the metal market shall have found itself substitutes are being used. There have been cases where bare copper wire has been used, although copper-clad may have been more desirable, just as where in one case in South America condenser tubes have recently been made of iron, even with their short life, as being cheaper in the end than present copper. Deliveries in bare trolley wire are running three to four weeks, as it is not stocked; it is, however, kept in rods.

Considerable standardization on rubber-covered wire and cable has been effected. Code, 30 per cent and 40 per cent are insulation standards. No. 8 B. & S. gage and smaller rubber-insulated N. E. C. with double-braided wire and twin wire will not be manufactured. Single-conductor single-braid will be substituted therefor. The number of standard colors of flexible cords has been limited to black, green, yellow, red and white. Lamp cord and brewery cord are the standard types of N. E. C. flexible cords.

In the manufacture of stranded conductors wires of even diameters have been eliminated and approximate diameters substituted therefor. Thus where 400,000 circ. mil is called for a cable of thirty-seven strands of No. 10 B. & S. gage wire, giving 384,095 circ. mil, will be sold. The same will hold good for other sizes. In some cases the approximate size will be nearer the even hundred than in the above instance, but in no case will it be very far off. There are the same number of steps between the present No. 16 and 2,000,000 circ. mil as formerly, and each step approximates more or less closely the former corresponding step.

DIFFERENCE OF OPINION OVER PRICE GUARANTEES

While Some Electrical Manufacturers Have Made Guarantees for Next Few Months, Others Are Opposed to Pursuing Such a Policy

A difference of opinion seems to exist among manufacturers of electrical supplies and appliances regarding the practicability of giving guarantees against a drop in prices over a definite period. Some manufacturers have already made such guarantees. A producer of high-tension apparatus has in effect guaranteed against a drop until March 1. A well-known line of lighting fixtures has been guaranteed against a decrease until April 1. There have been other concerns that have taken similar action.

On the other hand, there appears to be a well-defined opposition to doing this sort of thing. Inquiries made of appliance manufacturers showed little sympathy with the policy of giving such guarantees. It is well known that the prevailing high prices, particularly on heating goods, have been and are now especially acting as a drag on large sales. More than once the trade has asked for lower prices. With such a sentiment it is not strange that the manufacturers do not care to guarantee against drops. It has also come to light that the most insistent demand for guarantees has come from retailers without the electrical industry. Furthermore, the demand has been for guarantees over the first half of the current year. It is apparent that these interests wish to lay in stocks and at the same time take no risk.

HOPEFUL OUTLOOK IN THE WATT-HOUR-METER MARKET

Lower Labor Costs May Bring Down Prices, but Not in an Amount Sufficiently Substantial to Justify Holding Off Purchases of Meters

Conditions in the watt-hour-meter market justify the belief that 1919 promises to be a year of excellent business in this field. Factory stocks of the smaller-sized meters are ready for immediate shipments, and large orders can be filled as readily as before the war. Both labor and material are in ample supply to meet the demands of a real boom in building should that materialize within the next two or three months. This accumulation of smaller-sized meters is the result of the extremely conservative policy adopted by the central stations regarding line extensions and new services during the latter part of the war, coupled with the belief on the part of manufacturers that the curtailment of demand is merely temporary. The central stations are by no means short of meters as yet, but contracts are being renewed here and there in anticipation of a healthy development of service. Orders are still slow in coming in, and extended buying may be delayed until after the fifth Liberty loan. If the building trade picks up, as seems likely, the business in meters will increase accordingly. A quiet market for power meters seems likely to prevail.

Watt-hour meters for residential service moved very slowly last year in comparison with 1916. The restrictions of the Fuel Administration and the cessation of free line extensions by central stations, coupled with maximum conservation of building materials and labor, caused the sales volume in meters for home use to fall probably 40 or 50 per cent below the previous year's figures. Just before the armistice the demand for such meters represented a mere hand-to-mouth buying, and the extent of revival this year is in large measure dependent upon central-station activity. A beginning has been made in returning to a pre-war basis of financing extensions, as at Providence, R. I., Cleveland, Ohio, and elsewhere, and it is natural to expect a rapid growth in commercial effort among central stations as the year advances.

Manufacturers have been turning out large quantities of meters of all sizes for war service, and the industrial meter market last year was fully as good as in 1917. Some meters will be purchased this year in connection with the remodeling and rehabilitation of industrial plants, rearrangement of power and lighting distribution circuits, interchange of energy supplies and consolidation of loads; but until the readjustment of industry reaches a more stable plane orders are likely to show great variation in their specifications and volume. It is probable that deliveries will be very satisfactory in industrial meters this spring, despite the fact that the industrial demand is difficult to forecast. Early inquiries, nevertheless, will assist.

METAL MARKET SITUATION

Some Slight Reductions Noted, but Buying Is Quiet —Foreign Business Hoped For

The lowering of ocean freight rates gives promise of renewed buying in foreign markets. In the copper market the absence of the leading interests is expected to have a still more quieting effect. Prices are nominal and show a decided downward trend and at present rate should reach 19 cents in a few days. Considerable quantities of high-cost copper are still coming along.

Production is still being cut and will probably so continue till producers are satisfied there is a renewed market for their product. There is sufficient on hand to satisfy any sudden demand that may occur. Some mining companies are operating on 65 to 75 per cent capacity.

General users of tin report a quiet business. Letter No. 10 of Jan. 23 has been sent out to the industry under decision of the government authorizing the United States Steel Products Company to fill all orders at government prices, regardless of quantity. The recent drop in lead to 5½ cents has brought the selling price very close to cost.

NEW YORK METAL MARKET PRICES

	Jan. 21	Jan. 28
Copper:	£ s d	£ s d
London, standard spot	91 0 0	89 0 0
	Cents per Pound	Cents per Pound
Prime Lake	21.00	21.00
Electrolytic	20.00	19.25
Casting	18.25	18.00
Wire base	22.75*	22.75*
Lead, trust price	5.50	5.50
Antimony	7.50	7.50
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	13.00	13.00
Spelter, spot	7.35	7.00
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.00 to 9.50	9.00 to 9.50
Brass, light	7.50 to 8.00	7.00 to 7.50
Lead, heavy	4.50 to 4.75	4.50 to 4.75
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

* Nominal

THE WEEK
IN TRADE

SMALL-order business is now about all that is being handled. Utilities are beginning to borrow money, and some good business from this quarter is expected. There is a decided scarcity of dwelling accommodations in the United States. This condition is becoming accentuated day by day. Of ninety-one real estate boards interrogated by the Department of Labor fifty-nine replied that in their cities a non-fulfilled demand existed for houses and apartments, while twenty-four stated that at the present time this same condition exists to an acute degree. Only four of the ninety-one replied that there was little demand for housing accommodations.

Wire is lower again this week, but other prices remain steady.

Labor disturbances are becoming more numerous and appear to be springing up all over the country. A very decided surplus of labor is piling up.

NEW YORK

The statement last week from one of the largest real estate companies in the city that "Savings banks are now becoming more active in the loan market" should bring with it new assurance about building, from the viewpoint of mortgage possibilities. Further ground for optimism is afforded in the recall of governmental restrictions on loans by banks and trust companies. Remodeling of private dwellings into small apartments continues. One tall apartment house has just been announced for Fifth Avenue at Sixty-sixth Street. Except for insulated wire, which took another drop, prices show no change over last week. Government cancellations have so far been gradual.

There is still a dearth of very large orders in practically all electrical construction material, but maintenance and repair orders are keeping constantly in motion a small volume of business.

TRANSFORMERS.—Prices remain quite steady. While isolated industrial plants have stopped buying in any quantities, the central stations are purchasing sufficient transformers to maintain their lines and take care of a very fair amount of immediate new business. The latter are not, however, laying in any stock of transformers so early in the year, but this may be looked for in March and April.

LAMPS.—Orders are running rather high and are holding a steady level. This no doubt follows the discontinuance by the lighting companies of their former lamp-renewal policies. The previously large periodic peak sales to the lighting companies in this locality have flattened, and trade is now more evenly spread out. However, the volume of trade is expected to decrease as the days grow longer. Local stocks are ample. Considerable buying in high-voltage lamps indicates activity in the export trade.

PORTABLES.—The dry-goods stores have virtually sold out their entire stock. Sales as a rule are very high with dry-goods stores, but last year they had difficulty in procuring sufficient stock. The lighting companies consequently found a larger demand on their stock, and it is understood that as a result they are making plans to cultivate this business more intensively this year.

FLEXIBLE ARMORED CABLE.—Several jobbers have fair stocks and are not ordering anew till they have cleared pretty well their present supply; those not stocked are buying in small quantities for work in hand. One manufacturer is still running full on old orders. The drop in price of copper has not yet been found to affect this product.

NON-METALLIC FLEXIBLE CONDUIT.—Manufacturers claim that the pre-war price of this product was so cut by competition that it did not yield a fair profit. The

present prices they figure are none too high. The drop in cotton is speculative and has not effected any drop in price of the product, manufacturers state.

HEATING APPLIANCES.—There is a large local stock of radiant radiators on hand, due to the warm winter. These are being offered by some jobbers at lower prices. In one instance heaters are being offered to the trade at one-third less than the high early winter prices. There were more heating devices billed by manufacturers during the month of December last, it is reported, than for any previous month, and one large manufacturer expects to have all his back orders billed and shipped within the next two weeks. All of these back orders were accepted on the basis of shipping price. One of the local utilities recently placed orders for its requirements for the first half of the current year.

WIRE.—A further drop in wire prices occurred this week. One manufacturer dropped from 27 cents to 24 cents, rubber-covered base, another from 27 cents to 25 cents and a third from 28 cents to 25 cents. One producer who has been on 34-cent base for a few weeks changed this week to a cost basis. Rubber-covered base ranges from 24 to 29 cents.

MILL-TYPE LAMP.—In order to meet the demand for a more rugged lamp, tungsten-lamp manufacturers are selling in limited quantities until thorough service tests have been completed a specially constructed lamp in which the filament mount is fastened to the stem in the base by a short piece of steel wire. This tends to absorb vibrations, preventing them from reaching the filament. The filament has an extra number of anchors to prevent one filament leg overlapping another. These extra anchors make the lamp slightly less efficient than the standard lamp, and, on account of the expensive form of construction, the price is higher, the lamp listing at 45 cents clear for 110-volt to 125-volt circuits and 48 cents clear for 220-volt to 250-volt circuits. It is made in two sizes, 25 watts and 50 watts. A definite form of construction will not be settled upon until more experience has been obtained from the lamp in service.

CHICAGO

The interest of the trade is gradually swinging around more and more to the activities of public utilities. In the past week the Public Utilities Company of Evansville, Ind., has sold $3,000,000 of ten-year bonds at a price yielding about 6.65 per cent.

While the building operations have not been up to expectations, it is a notable fact that the total value of building permits issued week before last amounted to $572,250 as against $44,500 for the same week in the preceding year.

The price situation is one that is being studied very closely now both by the sellers and buyers. J. L. Replogle, who purchased steel for the allied nations during the war, has given out an interview stating that before long pig iron will be selling for $40 a ton and steel at $73 a ton.

Jobbers report that the usual number of orders are being secured but that they do not have the same volume as those secured last January. The reason for this situation is that buyers are purchasing on a hand-to-mouth basis.

It has developed that the distributers of electrical appliances are very much opposed to guaranteeing prices of appliances against decline for a definite period. They raise the point that this procedure would absolutely kill the market for appliances during the guaranteed period because such action would in effect state that prices were going down on a certain date in the future. They offer as an alternative a plan by which the manufacturers would protect the distributers' stock.

CONDUIT.—Virtually no conduit producers are yet in shape to ship a complete order of all sizes. There are always one or two sizes missing in each shipment. Deliveries, however, are easing up, and there is plenty of pipe on the market. Most of the Chicago jobbers have changed to Card 41, taking off the premium which they had placed on shipments out of the Chicago stocks.

POLES.—There seems to be a well-defined notion that prices of poles will be readjusted gradually and then only as the prices of commodities used most by the producer are altered. Labor is a large factor. Pine-pole producers are rather jubilant over the prospect of early imports of creosote oils, which will, they feel, reduce treating costs materially. Inquiries are coming in from central stations.

WASHING MACHINES.—The market is still intensively active. Middle Western manufacturers who have heretofore made only the dolly type are nearly all adding some cylinder-type models to their lines. Prices are quite steady. Deliveries are improving somewhat.

VACUUM CLEANERS.—The trade is watching with some interest an attempt which is being made to get all vacuum-cleaner manufacturers together to form a single central vacuum-cleaner manufacturing company.

BOSTON

Filling of back orders occupies the trade at this time, new business remaining quiet. Deliveries are steadily improving and prices are still firm in most lines. Stocks are fairly large. Credits are carefully watched and collections are somewhat slow, though not much real change is seen from week to week in this departmnt of trade activity. Central-station power business still holds up well. The Narragansett company of Providence, R. I., has resumed its pre-war policy relative to the financing of extensions, and none of the power contracts taken during the past year has been canceled. The Revere Rubber Compay, plant No. 2, recently contracted for 10,000 hp. from this company, and about two years will be required in the development of the load to the above maximum. Labor is becoming more plentiful in Massachusetts, but the recent army plan to retain men in service until they secure work in the civilian field will tend to relieve the overplus now rapidly accumulating in some sections. The tendency toward lower food prices is another factor which appears likely to be helpful in reducing unrest as wages decline.

LAMPS.—No reduction in prices seems likely to take effect before July. Business holds up well and stocks are improving, with resultant good deliveries.

APPLIANCES.—Energetic distributers report some gain in business for January compared with last year. The demand for portable lamps has been well maintained, and many stocks have been greatly reduced through post-holiday sales, even without customary mark-down prices. The influenza epidemic has hurt trade in some localities.

FARM-LIGHTING SETS.—One prominent dealer reports better sales in the first half of January than were booked in the entire last quarter of 1918. The high cost of line construction in thinly settled communities has helped this business get a start, and the publicity campaigns which have been run off have begun to bear fruit. Some purchasing of farm-lighting sets is reported for the merchant marine. Local stock reports offer immediate shipments.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are coming in steadily, but for the moment sales are a little dull. The factories are getting into better shape each month to handle a large civilian business.

ELECTRIC COAL LOADERS.—Inquiries are coming in well for the spring business, and the outlook is good despite a present slack period as to orders. Immediate deliveries can be made from stock.

ELECTRIC RADIATORS.—These units are moving well and the supply is keeping well up with the demand at present. The mild winter is leading to a widespread use of such equipment in limited service heating. Here and there retailers are cutting prices a little, but there appears to be no real necessity for it.

PORTABLE LAMPS.—Stocks are a good deal reduced, but many attractive offerings are left. Buyers do not seem to worry about prices, given a varied selection of types.

DISHWASHING MACHINES.—Interest is picking up fast, and one central station has ordered two carloads of machines for early delivery. The servant problem is still acute in many localities and motorized household devices bid fair to "sell themselves" this year.

FLASHLAMPS.—Trade is a little quiet, and one prominent manufacturer is reported to be soliciting orders on the basis of a guarantee against price reductions.

ATLANTA

Wholesale and jobbing trade is quiet, but probably no quieter than a week ago. Locally, manufacturing and industry continue active. Retail sales are as good as, if not better than, this time last year. Dealers in machinery note a slight falling off in collections, probably due to holding of cotton. High prices in materials retard building. Some activity is noted, mainly in the nature of repair work. The return of many soldiers has eased the labor situation.

The future of cotton prices is an item that is holding the center of the stage at this time. The entire cotton and textile industry has been in an uncertain position since the cancellation of war orders. Buyers have withheld orders until more definite information was available as to the disposition of goods owned by the government and raw materials purchased by the mills to cover their contracts, as well as the future trend of prices for the staple. Recent announcement of the terms of payment by the government on orders held up because of the armistice, which are considered very fair, will place the industry on a more settled basis. The mills have been running full, but the end of unfilled orders is in sight, with practically no new business being placed. It is expected that some curtailment will be necessary unless new orders are forthcoming. It now looks as if Congress will stop the housing program at Wilmington, N. C., Savannah and Brunswick, Ga. The fleet corporation has ample funds, but the idea is to hold up all work that is not well under way. A number of new plants are locating in the Terrebone gas field, Houma, La. These include the Louisiana Oxygen Company, Louisiana Crushing Company and the Refining Products Company.

FIXTURES.—Although wholesale requirements have dropped off, the call through retail channels appears to be holding up fairly well. This demand is coming from outlying and semi-rural sections. The volume of business in the larger centers has fallen off, and it is not expected that revival will take place until building work gets under way. Remodeling and decorating tends to stimulate sales for standard types. Portables are moving slowly and activity has practically ceased. Stocks are being held to a minimum.

SCHEDULE MATERIAL.—Knife switches, cut-outs, fuse plugs and sockets are moving fairly fast. Shipments are good and stocks are well maintained. Retail sales for repair and maintenance work are good, but on account of the lack of building no large orders are being placed.

TELEPHONE EQUIPMENT.—Jobbers report great activity in the rural or community type telephone systems. The call is growing more insistent, and inquiries are well above those registered for the same period last January. These outfits have been hard to get, but shipments are becoming more free.

WIRE.—There has been a decrease in the movement of weatherproof since last week, owing to the fact that outside construction has slowed up considerably. Rubber-covered, however, maintains its position fairly well. This section has received no notice of change in price this week.

SEATTLE—PORTLAND

The strike of approximately 30,000 shipyard workers and employees in contract shops in Seattle and approximately 10,000 in Tacoma predicted last week materialized Jan. 21. No particular attempts have been made to settle the controversy. The Metal Trades Council, representing the strikers, is determined if possible to call out other unions in a sympathetic strike, and a referendum vote is being taken. Electrical jobbers report that during the week no deliveries of any kind were made to shipyards. Local jobbers as a whole do not believe there is a possibility of a sympathetic strike, but expect that ship owners will sit tight and that a compromise will be effected in the near future. If the strike continues, naturally a general depression will result, including the electrical business.

January, always a slow month, is slightly under normal this year. Firms are engaged in taking inventories and checking up for the past year. Moreover, a feeling of uncertainty prevents heavy buying. Stocks are in good condition in all lines. No shortages are reported. Shipments from the East are coming through as fast as needed, although transportation facilities are still bad. During the week another decrease in wire occurred. Collections are not affected by strike conditions up to date, and continue satisfactory. Floods throughout Washington are doing considerable damage and tying up traffic.

The Seattle municipal lighting plant is closed down temporarily owing to a break of 600 ft. of wooden stave pipe at Cedar River Dam.

The Portland district reports that business in general in electric lines is not so good as it was this time a year ago. The outlook for the future, however, is encouraging. Salesmen are busy with prospects for heavy future orders. Reports from Spokane show that wholesale and retail trade is fair. Manufacturing is quiet, but collections are in good condition. A general feeling of uncertainty pervades the Tacoma district and retail trade is not very active. Merchants are buying cautiously, and it is believed this condition will continue for some time. With most of the dealers pretty well stocked up, no large orders are contemplated at present.

A large amount of public improvement work is contemplated for early spring, and plans are being prepared for a number of big projects in Seattle. Irrigation work promises to be exceptionally active, and numerous inquiries are booked by local jobbers for electrical equipment and material for this work. The Legislature now in session in Olympia is expected to pass on several large irrigation projects which will be undertaken during the year.

SAN FRANCISCO

Business continues at a good rate. Orders are of rather small size, it is true, but there are many of them. Industrial-plant business has fallen to mere maintenance material. The buying public shows an unprecedented interest in electrical household helps, but there is a disposition to investigate various makes before purchasing, an attitude due probably to the present first cost of such devices.

The snowfall is alarmingly light on the Sierras, only 47 in. being reported at Summit, a 7000-ft. elevation, although there is a deeper pack in the lower valleys where the big Pacific Gas & Electric Company lakes are located. Unless the situation is bettered within the next month, the 1918 drought and artificial irrigation will be repeated. Rains have been generous along the coast and central valleys, and indications are for a banner year for all sorts of natural products.

Credits and collections are reported very good—principally because of the gradual weeding out of "lame ducks" or their absorption into factories. It is expected that returning soldiers who have acquired electrical experience in the Signal Corps or Engineer Corps will try to reënter the electrical field. Many have already been given positions in motor-winding shops or with electrical contractors. A 3600-acre tract near Fresno for returned soldiers has been tentatively set aside which may really solve absorption difficulties.

There are few outstanding construction features of the past week, save that the railroads are again at work on such construction as new roundhouses and stations, something that has not been undertaken for the last two or three years.

STREET LIGHTS.—One of the first street-lighting jobs reported after the removal of the non-essential ban is that of Palo Alto, where the trustees have authorized bids.

FANS.—Active solicitation for the summer season will soon begin. It is hoped in the trade that the season will be better than was last year, and possibly the lessening of urgent demands for other sorts of work will put jobbers in a better position to solicit the trade intelligently. Prices run about the same as last year, perhaps 5 per cent higher.

EXHAUST FANS.—Many sales of exhaust fans are reported because of the increasing construction of small restaurants, offices and auditoriums, where they are a necessity.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	+20%
Coil to 1000 ft	List
No. 12 Solid	
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

No. 14 Solid	
Less than coil	$115.00
Coil to 1000 ft	100.00
No. 12 Solid	
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	[illegible]	10.00
¾	[illegible]	13.00
1	250	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip.	$75.00	$63.75— 69.75
½-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
¾	.09	1½	.40
¾	.12	1¾	.47
¾	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00–50.70	$24.60–35.20	$23.00–30.25
½-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.00–26.50
½-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	[illegible]

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	⅛ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7.1%	9% to 9.1%
2500 to 5000 lb.	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅛ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to +3%	+3.5% to +1%
2500 to 5000 lb.	+2.5% to +2%	+5% to +4%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.50 to $7.00
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.18—$40.77
Coil to 1000 ft.	28.60— 32.98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00–$38.00
Coil to 1000 ft.	27.00– 28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	5%
1/5 to std. pkg.	15%
Std. pkg.	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $21.00
1/5 to std. pkg.	17.00 to 17.85

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00–$24.15
1/5 to std. pkg.	17.85– 21.00

Standard package, 2200. List per 1000, 20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$16.00	$32.00
1/5 to std. pkg.	13.60	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg.	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25% +15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5 to %5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	+2% to 8%
$25 to $50 list	+5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+35% to list
1/5 to std. pkg.	+5% to 10%
Std. pkg.	+10% to 18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—		List Each
No. 155	...	$0.34
No. 160		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2.00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.54– $0.66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.53 to $0.90
No. 18, full spools	.435 to .64

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$17.50–$25.00	$12.00–$17.00	$12.00–$15.00
12	22.20– 27.09	19.98– 23.22	16.65– 23.22
10	30.20– 32.40	27.18– 32.40	21.75– 27.45
8	37.62– 45.72	34.49– 45.72	30.10– 38.10
6	59.58– 72.36	54.62– 60.30	47.66– 57.88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$20.00–$24.00	$15.00–$17.00	$13.50–$15.00
12	25.83– 30.48	25.83– 30.48	25.83– 26.67
10	35.77– 42.32	35.77– 42.32	30.66– 37.03
8	49.84– 50.36	49.84– 59.36	42.72– 51.94
6	79.80–101.28	68.40– 88.62	68.40– 88.62

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$31.75 to $34.75
25 to 50 lb.	31.75 to 34.75
50 to 100 lb.	30.75 to 33.75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$34.76 to $39.75
25 to 50 lb.	33.76 to 38.75
50 to 100 lb.	32.76 to 37.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Unit-Type Busbar Spacers

Where short-circuit forces will subject busbar supports to a cantilever pull busbar spacers are desirable. The tensile and compression strength of the supports is greater than their

ANY NUMBER OF UNITS AND CLAMPS MAY BE COMBINED

cantilever strength, but when spacers are installed the cantilever pull on the busbar supports is practically neutralized. Bus spacers are subject only to tensile or compression forces and will therefore withstand much greater forces than supports under a cantilever pull. The Delta-Star Electric Company of 2433 Fulton Street, Chicago, has developed and is marketing new spacers which are of the standard unit-type design.

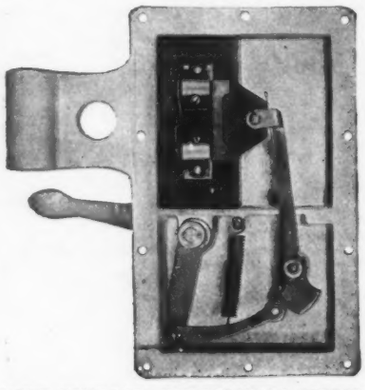
Master Controller

A new multi-speed full-reverse master controller that may be mounted horizontally or vertically, thus permitting in the former case a straight-line movement of the handle and in the latter case a radial movement, has been brought out by the Cutler-Hammer Manufacturing Company of Milwaukee. This master switch is smaller than previous designs and is intended for use with automatic magnetically operated controllers. It is said to be especially useful in connection with steel-mill and crane controllers, where the operator's attention should not be diverted from the work or machine and where space is limited.

An internal-gear drive which is entirely inclosed but is readily accessible by the removal of four screws in the lower portion of the operating handle eliminates the liability of accident to operators through the catching of fingers or clothing in the bevel gears often employed in straight line-drive control. A centering latch operated by a button in the handle indicates to the touch the "off" position of the master, while a strong notching spring is used to indicate the five positions in either direction. A maximum of twelve fingers may be mounted on the fingerboard, using six in one direction of rotation and six in the other. The new controller, although very small and compact, is so designed that by the removal of two bolts the entire finger board may be taken from the frame, while the removal of three bolts allows the entire shaft and contact fingers to be withdrawn. Inspection, renewals and repairs are, therefore, said to be easily effected. The construction of the finger board and drum follows the standard practice of this company in that the fingers and segments are clamped to square insulated steel shafts and adjacent contact points are separated from each other by arc barriers.

Inclosed Tank Switch of Single-Pole Double-Break Type

For regulating pumps connected with tanks, sumps, receivers and like receptacles, an inclosed switch of the single-



FIXED CONTACTS ARE MADE OF CARBON

pole double-break type has just been placed on the market by the Blackburn-Smith Corporation, 105 West Fortieth Street, New York City. The movement of a float operated by means of "grasshopper" levers moves a roller across a cam on the end of the electrical contact lever, the roller being held closely to the cam by a spring. This spring throws the contact lever with a positive motion at the instant the roller passes over the cam's center.

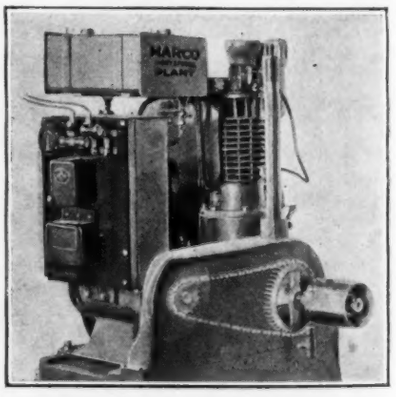
A block of transite ebony asbestos supports the fixed contacts and also acts as an insulating bushing for the incoming wires which are brought through a boss in the back of the case, the boss being threaded to receive a ¾-in. (1.9-cm.) conduit. The fixed contacts are short cylinders of carbon held by set screws in machined brass terminals bolted to and insulated by the transite block. The moving contact is a folded copper strip bolted to a piece of transite which is loosely pivoted in the forked end of the cam lever.

The switch, which may be waterproofed if desired, is furnished either alone or with its accessories, which include a cast-iron stand and bracket, a float of 16-gage spun copper, and the guide rod, which is of seamless drawn brass tubing with aluminum stops and collars.

Chain-Drive Light and Power Plant

A distinctive feature of the new "Marco" farm lighting and power plant being made by the Marmon-Chicago Company of Chicago is the silent-chain drive used to connect the engine and the generator. A number of advantages for the plant are claimed through the use of this method of connection. Belt slipping and the loss of power often characterizing belt-driven plants are done away with, and, unlike some of the directly connected types, the engine of the "Marco" plant, according to its maker, can be geared to run the generator at a high speed without racking the engine, thus making for long life. The chain drive permits the use of a low-speed kerosene engine of 800 r.p.m. geared to an electric generator with a rating of 1800 r.p.m.

The new plant is a single compact unit, the engine, generator and control system being mounted on one base. The air-cooled 4-hp. engine, however, can be removed from the base in five minutes, mounted on field machinery and used to run binders and similar instruments. The engine also may be used to operate churns, freezers



ENGINE AND GENERATOR ARE COMPACTLY MOUNTED ON ONE BASE

and other labor-saving devices indoors, thus making the "Marco" plant a dual power outfit that supplies both kerosene engine and elec-

trical power. Both the engine and the 1250-watt generators are said to have an overload capacity of 25 per cent. While the plant is made in two models, one being a fifteen 20-watt light set and the other a one hundred 20-watt light outfit, the generator and the engine are the same in both cases, the batteries alone differing in size.

The control apparatus used with these outfits is said to be very effective in regulating the current entering the batteries. By its use the current "tapers off" as each cell becomes charged, thereby preventing injury to the battery through overcharging. The control is designed to maintain a constant voltage regardless of engine speed, and should the governor slip or be incorrectly set the control will prevent overloading the generator and a consequent burning out of lights, fuses or equipment. In this manner meters, rheostats and other puzzling devices are eliminated, says the manufacturer, making the operation of the plant "simplicity itself," only a push button being used to start it.

Heavy Overload Ammeter

A commercial ammeter which it is claimed will withstand a momentary sixty-fold overload is being marketed by Nalder Brothers & Thompson, Ltd., of 97a Dalston Lane, London. Owing to special construction the maker says that this new ammeter is exceptionally "dead-beat" and has a very light movement for its size. The pivots are easily removable for repolishing and the scale is approximately logarithmic, so that it is said an overload of double the normal current can be observed while at the same time the regular scale reading is not impaired. The instrument is spring-controlled and can be read in any position. It is housed in an open-fronted case with an 8-in. (20-cm.) dial to match the power-factor indicator and the rotary sychroniser made by this company.

Combination Expansion Bolt and Hanger

The functions of an expansion bolt and a conduit hanger are combined in a single piece of apparatus manufactured by the Chicago Expansion Bolt Company, 330 West Washington Street, Chicago. This device has a U-shaped body which clamps the pipe and is also provided with an expansion attachment which holds it securely to the wall or ceiling. It is installed by inserting the expansion or straight end of the device into a hole, after the conduit has been placed in the hanger, and driving the metal wedge with a fluted hammer into the lead expansion member which fills the crevices in the hole drilled to receive it. The manufacturer claims that the ¼-in. (6-mm.) size will sustain from 1500 lb. to 2000 lb. (680 kg. to 907 kg.) in direct pull, depending upon the masonry. The advantages claimed by the manufacturer are those of minimum drilling in brick or concrete, less labor required to install, less material required and neatness of installation. The device is made in sizes adapted for all sizes of conduit and can be furnished in galvanized, black or plain finish.

MAY BE EASILY AND NEATLY INSTALLED

Plug That Fits on All Heating Appliances

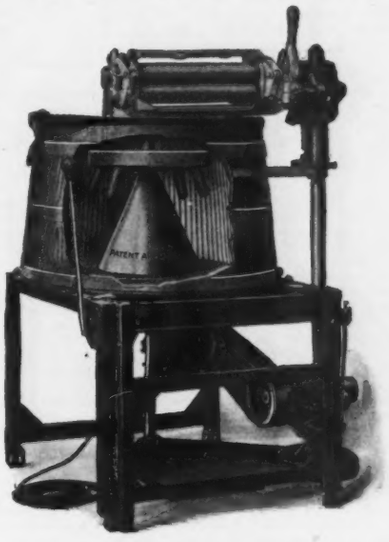
Electrical heating appliances are made with different kinds of terminals so that when an iron, a toaster and a stove of different makes are used in a home it is frequently necessary to have three cords and three different attachment plugs. To eliminate this inconvenience the Redtop Electric Company of 8 West Nineteenth Street, New York City, has just placed on the market the "Fitzall" attachment plug which fits the terminals of all table stoves, heaters, toasters, irons and other electrical heating appliances.

The connector clips used in the new plug are formed of two pieces and offer a flat surface to make contact with a flat terminal and a round surface for making connection with a round terminal. One of the two pieces is made of spring brass and is formed to preserve its resiliency, thus preventing spreading of the clip and insuring a perfect contact even after long use. Another feature of the plug is the elimination of loose nuts, since the machine screws holding the two halves of the case together screw into threaded bushings which are molded into the case. Black heat-proof composition, knurled on the sides and highly polished, is used for the case, which has no spring attached since the openings for the cord are made with rounded edges and therefore prevent fraying.

Improved Dolly-Type Clothes-Washing Machine

An electric washing machine has been placed on the market by the Hirschy Company of Minneapolis which has an inverted cone-shaped device projecting below the usual "dolly" agitator in the center of the tub. Through its use the clothes are kept from collecting in a heap in the center of the washer and are forced into a wide circle and a greater volume of water, the slant of the cone causing the water to be greatly agitated. In this way hot soapsuds are forced through clothes, it being pointed out that the top lip on the cone prevents the clothes from rubbing against the dolly and so eliminates wear and tear.

With the exception of the tub, made of Southern cypress, the entire machine, including the double folding platform for two extra tubs, is constructed of metal. Motors for different kinds of electric service may be obtained and all the machinery and gears are inclosed and out of the way. Attached to the transmission gears is a small pulley which may be used to run an ironing machine or other labor-lightening devices. A lever, conveniently located, controls the operation of the washer, another feature of which is the three-position, tilting, ball-bearing wringer having tension springs to adjust the rolls for thick and thin clothes and a positive safety release which unlocks the top roll when lifted.



CONE DEVICE PREVENTS CLOTHES COLLECTING IN A HEAP

Peanut-Butter Machine

An improved model of the electrically operated peanut-butter machine made by the A. J. Deer Company of Hornell, N. Y., has been placed on the market in two sizes, one having a ½-hp. motor and making about ¼ lb. (0.15 kg.) of peanut butter per minute and the other being driven by a 1-hp. motor and having a production capacity of approximately ¾ lb. of butter (0.3 kg.) per minute. Because gears are used to connect the motor with the grinders the maker states that the most suitable speed for this kind of work is secured. The use of special steel burrs in grinding the peanuts is said to insure making proper fineness in the butter. All working parts of the machine are heavily tinned and nickeled. Cleaning is simple. The machine, which in its exterior resembles a coffee grinder, may be secured for either alternating or direct current, a conveniently placed snap switch controlling the motor.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An electrician in Spain (No. 28,112) desires to secure an agency for the sale of electric lamps, electrical goods and fittings of all kinds. Correspondence should be in Spanish.

A firm in Norway (No. 28,120) desires to purchase and secure an agency for the sale of engines, boilers, light, heat and power equipment, wireless telephone and telegraph apparatus, internal-combustion engines and railway and tramway equipment.

The following cablegram, dated Jan. 14, has been received by the Bureau of Foreign and Domestic Commerce from the American Consul at Brussels, Belgium: "Please send immediately for Central Committee of Belgian Industries, coöperating with government, catalogs and trade journals for electrical machinery, belting, tanned leather, machine tools, automobiles, motors and hardware for reconstruction."

Rojas, Randall & Company, 26 Beaver Street, New York City, are desirous of getting in touch with reliable manufacturers of telephone and telegraph wire, modern telephone apparatus for Morse, Hughes and Baudot systems and electrical machinery in general, including turbines. This material is to be used in Spain.

The Bureau of Foreign and Domestic Commerce is in receipt of several trade lists from representatives in the Far East which may be obtained from the bureau or through its district or coöperative offices by referring to file number in parentheses: Electrical supply dealers in Bombay, India (9519); leading industrial and engineering firms in Ceylon (9525).

GOVERNMENT SPRUCE BOARD TO SELL MOTORS.—Ten million dollars' worth of equipment owned by the United States Spruce Production Corporation, with headquarters in the Yeon Building, Portland, Ore., is to be sold, and sealed bids for the same will be received by the sales board up to and including Feb. 15. Included in the equipment are alternating-current motors, 440-volt, three-phase, 60-cycle, from 3 hp. to 75 hp., with or without starter.

TO LAUNCH ELECTRIC SIGN CAMPAIGN.—The Federal Sign System (Electric) is just about to launch an effective sales effort on electric signs. This campaign will have several features. An effort will be made to reach responsible executives of central-station companies with information showing electric signs as revenue producers which do not require much extra investment cost. The slogan of the popular campaign will be "Brighten up for the homecoming of the boys." This promises to be quite popular, judging from the results that have been observed in Indianapolis, Minneapolis, Chicago and Cincinnati, where some newspaper copy based on this slogan has been used. In order to assist the central stations in this work the Federal Sign System (Electric) has worked out a plan for carrying accounts where signs are purchased by merchants on time. This will relieve central stations of financial obligations that some of them are ill prepared to carry.

YOUNG BROTHERS INSULATED STEEL OVENS IN DEMAND.—The Bradford-Ackermann Corporation of 30 East Forty-second Street, New York City, Eastern representative of the Young Brothers Company, manufacturer of insulated steel ovens, reports a large amount of interest in electrically heated ovens for japanning, enameling, drying, and core and mold baking. The firm reports business in this line during 1918, closed and in operation, as follows: Curtiss Aëroplane Corporation, Buffalo, N. Y., kiln oven for japanning aëroplane parts; General Electric Company, Schenectady, N. Y., seven ovens, kiln type, for general electric machinery drying and baking; Federal Shipbuilding Company, Newark, N. J., kiln ovens for drying armatures and coils; Fillmore Avenue Foundry & Iron Works, Buffalo, N. Y., kiln oven for japanning; Ericsson Manufacturing Company, Buffalo, N. Y., drawer-pull oven for japanning Berling magnetos; Fairbanks Company, Philadelphia, two ovens (one for France) for japanning aëroplane parts; Taylor-Wharton Iron & Steel Company, High Bridge, N. J., drawer-pull oven for foundry core baking; S. O. & C. Company, Ansonia, Conn., kiln oven, recirculating system, for japanning eyelets, etc.; Sprague Electric Works, Bloomfield, N. J., kiln oven for drying armatures and coils; Connecticut Electric Steel, Hartford, Conn., drawer-pull oven for foundry core baking; Crouse-Hinds Company of Syracuse, N. Y., kiln oven for foundry core baking; Pratt & Whitney, Hartford, Conn., drawer-pull oven for core baking. In addition, the Electro Dynamic Company of Bayonne, N. J., purchased three large kiln ovens, steam-heated, for drying the armatures used in its interpole motors and generators. This company also purchased a special continuous conveyor oven, gas-heated, which is used in the drying of varnish insulations on the armature and field-pole laminations. These laminations were formerly air-dried, requiring about forty-eight hours, and the whole operation now is done, more effectively, in the short interval of three minutes.

C. N. BARNEY, 115 Broadway, New York, has been appointed to act as local representative for the Worthington Pump & Machinery Corporation.

W. K. BROWN has been appointed district manager of the Crocker-Wheeler Company at Newark, N. J. Mr. Brown was formerly joint sales representative of the company with C. E. Ingalls at San Francisco. Mr. Ingalls now becomes district manager at San Francisco for the company.

THE H. W. JOHNS-MANVILLE COMPANY is reported to have purchased a tract of 255 acres on the lake shore at Waukegan, Ill., upon which it intends to construct a three-million-dollar plant to manufacture asbestos and magnesia products. The plant is to have a capacity of 35,000 cars yearly, and it is understood that it will employ 2500 to 3000 people.

CAPT. EDWARD E. ASHLEY, JR., for many years consulting mechanical and electrical engineer for Starrett & Van Vleck, architects, New York City, has resigned his commission in the Air Service of the United States Army to accept an appointment as sales engineer of the Mercury Manufacturing Company, Chicago, Ill., manufacturer of electric industrial trucks.

THE AMERICAN PIPE BENDING MACHINE COMPANY, with offices at 39 Pearl Street, Boston, Mass., announces that it is about to open pipe-bending plants in all large cities throughout the country. The first plant is about ready for operation at Lowell, Mass. "Wonder" pipe benders, manufactured by this company, will be used at all plants. Each plant will have facilities for turning out from 1000 to 3000 bends per day. The present company was capitalized at $100,000. The old company is about to be reorganized with a capital of $1,000,000 to carry on this business.

THE CENTRAL TELEPHONE & ELECTRIC COMPANY, St. Louis, Mo., has recently become one of the agent-jobbers of the Westinghouse Electric & Manufacturing Company. F. D. Phillips, who is president and sales manager of the Central Telephone & Electric Company, started in the electrical business with the Electric Appliance Company of Chicago, Ill., and remained with that company until about thirteen years ago, at which time he came to St. Louis, where he has been identified with the jobbing business up to the present time. In May, 1916, he purchased the stock of the Central Telephone & Electric Company. In line with its new policy the company's warehouse space has been greatly increased, which enables it to carry a larger stock.

J. N. ADAM, who for the past nine years, has been connected with the new-business department of the Public Service Electric Company of New Jersey, has become associated with S. C. Schrenck, Eastern manager for the Belden Manufacturing Company of Chicago. He will cover the Metropolitan district, as well as the southeastern section of the Atlantic seaboard. During his association with the Public Service Electric Company Mr. Adam was very prominent in the various activities of the company, as well as an active member of the Illuminating Engineering Society and the National Electric Light Association. As a member of the former society he served on a number of important committees and has been for the past six years a local representative for New Jersey. He is at this time chairman of the store-lighting committee of the N. E. L. A.

Trade Publications

CUT-OUT BOXES AND CABINETS.—The Allsteelequip Company, Aurora, Ill., has distributed a new electrical cut-out box price list.

VACUUM CLEANER.—A folder on the Eureka vacuum cleaners has been issued by the Eureka Vacuum Cleaner Company of Detroit, Mich.

LIGHT AND POWER PLANTS.—The improved models of its "Alco" farm lighting and power plants are the subject of a folder issued by the Automatic Light Company of Minneapolis, Minn.

MASSAGE VIBRATOR.—A two-color folder about the "Star" massage vibrator has been prepared by the Fitzgerald Manufacturing Company of Torrington, Conn., which makes this device.

EXTERNALLY OPERATED SWITCHES.—The Trumbull Electric Manufacturing Company of Plainville, Conn., is distributing its bulletin No. 2, cataloging "safety service" externally operated switches.

BOILERS.—"The Heine Idea" is the title of a booklet issued by the Heine Safety Boiler Company of St. Louis, Mo. This publication is illustrated and touches briefly on the boilers and superheaters made by this concern.

OIL STORAGE AND DISTRIBUTION.—The latest booklet issued by the Wayne Oil Tank & Pump Company of Fort Wayne, Ind., deals with storage and distribution systems for oils, varnishes, gasoline and similar materials.

INCLOSED TANK SWITCH.—Bulletin SX-60, which is descriptive of its new inclosed switch for regulating liquid levels in tanks, sumps, receivers, etc., will shortly be issued by the Blackburn-Smith Corporation, 105 West Fortieth Street, New York City.

WATERWHEEL-DRIVEN GENERATORS.—The General Electric Company of Schenectady, N. Y., has published a forty-page booklet entitled "Waterwheel-Driven Generators" which contains illustrations of many hydroelectric stations using apparatus manufactured by this company.

HEATING APPLIANCE PLUG.—The "Fitzall" plug, which is said to fit all makes of irons, stoves, toasters and other heating apparatus and which is marketed by the Redtop Electric Company, 8 West Nineteenth Street, New York City, is the subject of a leaflet from that company.

DISPLAY CASE LIGHTING.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has published a new booklet on display-case lighting with X-ray reflectors. "Scoopettes," "Hoodettes" and other X-ray lighting equipment are described in this illustrated booklet, which also gives general information on showcase illumination.

New Incorporations

THE WILLIS ELECTRIC CORPORATION of Buffalo, N. Y., has been chartered under the laws of Delaware with a capital stock of $100,000 to manufacture electrical specialties. The incorporators are James A. Willis, E. B. Parson and S. C. Dyer.

THE SUNLIGHT ARC CORPORATION of New York, N. Y., has been chartered with a capital stock of $1,000,000 by J. J. Harmer, 2585 Concourse; J. S. Dawley, 218 West Forty-eighth Street, and E. S. Porter, Hotel Thersea, New York City. The company proposes to manufacture a patented arc lamp.

THE HYDRO-ELECTRIC CORPORATION of Philadelphia, Pa., has been incorporated by F. R. Hansell of Philadelphia, Pa.; E. M. MacFarland and J. Vernon Pimm of Camden, N. J. The company is capitalized at $100,000 and proposes to promote and build electric light and power plants, etc.

THE LAURAINE MAGNETO COMPANY of New York, N. Y., has been incorporated by H. Burke, 59 West Forty-fourth Street; T. H. Murphy, 61 Broadway and H. B. Arden, 78 West Thirty-fourth Street, New York City. The company is capitalized at $1,250,000 and proposes to manufacture electric generating machinery

New England States

QUINCY, MASS.—The Quincy Electric Light & Power Company has petitioned the Gas and Electric Light Commissioners for an approval of an increase in capital stock from $300,000 to $400,000. The proceeds are to be used to take up outstanding indebtedness incurred for extension and improvements to its plant.

TURNERS FALLS, MASS—The capital stock of the Turners Falls Power & Electric Company has been increased by $2,409,100.

NEWPORT, R. I.—Work has begun on the erection of a heating plant and cold storage building at the local naval station, to cost about $1,000,000.

BRIDGEPORT, CONN.—The Fire Commissioners are contemplating the construction of a police station on Caroline and Arctic Streets, to cost about $75,000.

SIMSBURY, CONN.—The capital stock of the Simsbury Electric Company has been increased from $15,000 to $20,000, to provide for improvements made during 1918.

Middle Atlantic States

AUSABLE FORKS, N. Y.—The Ausable Forks Electric Company has petitioned the Public Service Commission for permission to construct a new electric plant at Jay. The cost of the proposed plant is estimated at about $25,000.

CALLICOON, N. Y.—The distributing system, franchise and rights of the Callicoon Independent Electric Company have been purchased by the Livingston Manor Electric Company. The local generating plant was not included in the sale.

CANISTEO, N. Y. — Bonds to the amount of $15,000 have been voted for the purpose of establishing a municipal lighting system in Canisteo. Of this $7,000 will be used to purchase the street-lighting system of the Canisteo Light & Power Company. It is proposed to erect a new building and install a new 35-hp. oil engine to operate the 50-kw. generator in the present plant.

COHOES, N. Y.—Bonds to the amount of $2,500,000, it is reported, have been issued by the Cohoes Power & Light Corporation. Part of the proceeds will be used for extensions and improvements.

ITHACA, N. Y.—Plans are being prepared for the erection of a new boiler plant at the works of the Remington Salt Company at Cayuga Lake, to cost about $25,000.

LIVINGSTON MANOR, N. Y.—The Livingston Manor Electric Company has purchased the distributing system, stock, franchises and rights of the Callicoon (N. Y.) Independent Electric Company. The Livingston Manor company contemplates the erection of an electric transmission line from Jeffersonville to Hortonville to connect with the Callicoon line and also to connect the newly acquired system with the local plant. The above purchase and contemplated changes are subject to the approval of the Public Service Commission.

MONROE, N. Y.—Notice has been filed by the Orange Rockland Electric Company with the Public Service Commission of a merger with the Warwick Valley Light & Power Company.

NEWFANE, N. Y.—A committee has been appointed to take steps to secure improvements to the street-lighting system. J. A. McCollum is chairman of committee.

NEW YORK, N. Y.—Plans have been filed by the United Electric Light & Power Company, 130 East Thirteenth Street, for the erection of a motor-generator house, 74 ft. by 26 ft., one story, on Academy Street, near 201st Street, to cost about $16,000.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 10, under Specification 3607, for coal and ash-handling equipment at the New York Navy Yard. The cost is estimated at $80,000.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 10, under Specification 3749, for installing refrigerating equipment at Ward's Island, N. Y., to cost about $30,000. A deposit of $10 will be required for plans.

NEW YORK, N. Y.—Plans have been filed by the Standard Concrete Steel Company, 105 West Fortieth Street, for the erection of a three-story building, 100 ft. by 175 ft., on West Sixty-first Street, near Amsterdam Avenue,, to cost about $200,000. A portion of the building will be used as a machine shop.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—Plans are being prepared by the New York Telephone Company for the erection of a new telephone exchange building, about 100 ft. by 100 ft., at 167th Street and Grand View Place. The company, it is understood, is also considering the construction of an exchange building, 50 ft. by 100 ft., in the Bath Beach district, Brooklyn. McKenzie, Voorhees & Gmelin, 1123 Broadway, are architects for the company.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has applied to the Public Service Commission for permission to issue $750,000 in bonds, the proceeds to be used for proposed extensions.

SPRINGWATER, N. Y.—Application has been filed with the Public Service Commission by the Springwater Electric Light Company for permission to construct and operate an electric light plant in Springwater, and also for approval of the exercise of a franchise granted by the town authorities in January, 1918.

SYRACUSE, N. Y.—The entire boiler house and part of the plant belonging to Procine & Rossi, 408 East Division Street, was recently destroyed by fire, causing a loss of about $10,000.

WEST ALBANY, N. Y.—The New York Central Railroad Company is planning to erect an engine house at West Albany, to cost about $70,000. W. J. Wilgus, Grand Central Terminal Building, New York City, is chief engineer.

BRUNSWICK, N. J.—Plans are being prepared by Alexander Merchant, 363 George Street, for the erection of a vocational school on Easton Avenue, to cost about $60,000. A mechanical department equipped with machinery is included in the plans.

CAMDEN, N. J.—Plans have been filed and contract awarded to the Fraser Brace Company, 1328 Broadway, New York, by the New York Shipbuilding Corporation for the erection of a new substation at its plant, to cost about $25,000.

ELIZABETH, N. J.—Plans have been prepared by the New York Telephone Company for the erection of a new telephone exchange building at 1192-96 East Grand Street, to cost about $50,000.

NEWARK, N. J.—An appropriation of $100,000 to provide for light, heat and power at the County Hospital at Overbrook for 1919 has been approved by the Board of Freeholders.

NEWTON, N. J.—Plans are under consideration by the township committee for an addition to the electric plant at the local almshouse.

TRENTON, N. J.—Plans have been prepared for the erection of a new factory for the Hutchinson Storage Battery Company, 230 South Warren Street.

ALLENTOWN, PA.—Plans are being prepared for the construction of a new electric lighting plant to be operated in connection with the municipal waterworks system. It is proposed to install a steam-driven electric generating plant, using the excess boiler capacity at the pumping station to generate electricity for street-lighting purposes, etc.

MAUCH CHUNK, PA.—Plans are being prepared by M. G. Prutzman, Court House, for the installation of a new electric plant.

PHILADELPHIA, PA.—The low bid submitted to the city for the construction of the proposed power plant, fire and police station, to be erected at Twenty-fourth and Rittner Streets, was submitted by the Frank H. Stewart Company, 37 North Seventh Street, at $304,245.

WILKES-BARRE, PA.—Plans have been prepared for the erection of a new one-story power plant for the Vulcan Iron Works, 730 South Main Street, at Buttonwood, near Wilkes-Barre. Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., are engineers.

SALISBURY, MD.—The Salisbury Ice Company is contemplating the construction of an ice plant. The equipment will include electric motors and hoisting elevators.

MARTINSBURG, W. VA.—Sprinkle Brothers, it is reported, would like to receive prices on electrical equipment for a printing plant.

ALEXANDRIA, VA.—Plans have been announced by the Navy Department, Washington, D. C., for the construction of a new torpedo station at Alexandria. Work, it is understood, will begin in the spring.

HAMPTON, ROADS, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 17, under Specification 3328, for mechanical equipment, piping, etc., for Hampton Roads, to cost about $125,000. A deposit of $10 will be required for plans. Bids will also be received until Feb. 10, under Specification 3300, for installing coal and ash-handling equipment at Hampton Roads, to cost about $60,000. A deposit of $10 will be required for plans.

WASHINGTON, D. C.—Plans are under consideration by the United States Housing Corporation for the construction of a new single-track street-railway system on Seventeenth Street, to cost about $125,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., in the near future, for furnishing at the various navy yards and naval stations supplies as follows: Alexandria, Va., Schedule 3667—two switchboards, fourteen panels and six disconnecting switches. Brooklyn, N. Y., Schedule 3677—27,000 ft. three-conductor cable. Eastern and Western yards, Schedule 3681—miscellaneous charging stations; Schedule 3683—various kinds of wire and cable. Bids will be received until Feb. 3, under Schedule 7718½, for searchlight carbons at the Eastern and Western yards. Bids will also be received until Feb. 10, under Schedule 7730½, for furnishing three-conductor cable at Hampton Roads. Applications for proposal blanks should give the schedule desired by number.

North Central States

BAY CITY, MICH.—The City Council is considering building an addition to the municipal electric light plant, to cost about $125,000.

DETROIT, MICH.—The Edmunds-Jones Corporation of Detroit is considering an addition to its works, to cost about $35,000. The company manufactures lamps.

KINDE, MICH.—Bonds to the amount of $10,000 have been voted for the installation of an electric lighting system in Kinde.

LANSING, MICH.—The City Council has authorized an issue of $25,000 in bonds, the proceeds to be used for extensions to the present ornamental lighting systems.

CINCINNATI, OHIO.—Steps have been taken by the united boulevard lighting committee to request the city authorities to put into effect at once the contract with the Union Gas & Electric Company for ornamental lamps in the downtown business section. Contracts have been signed and all necessary arrangements have been made with the Union Gas & Electric Company for the installation of ornamental lamps in practically all the streets between Central Avenue and Broadway and Fourth and Eighth Streets, to cost about $100,000. For further information address Thomas J. Ryan, president of the Business Men's Club.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Feb. 6 for transformer cases for the division of light and heat. Specifications may be obtained upon application to Room 204 City Hall.

MILAN, OHIO.—Steps have been taken by farmers living in the vicinity of Milan to organize a company to operate an electric plant to furnish electricity for lighting their dwellings and operating farming machinery, etc. It is proposed to locate the power house in Milan. Roy M. Fish, George Brandt, George Mason and others are interested in the project.

ANDERSON, IND.—The city of Anderson has applied to the Public Service Commission for authority to issue $90,000 in bonds for extensions and improvements to the municipal electric light plant and waterworks system.

INDIANAPOLIS, IND.—The erection of a two-story addition to the municipal garage is under consideration.

PRINCETON, IND.—Work will begin at once by the Princeton Light & Power Company on the installation of a new street-lighting system. The present arc lamps will be replaced with large incandescent lamps. The new system was ordered two years ago, but was held in abeyance owing to war conditions.

SOUTH BEND, IND.—The erection of a social center building at the Notre Dame University, to cost about $50,000, is under consideration.

SOUTH BEND, IND.—The Studebaker Corporation is planning to complete its new automobile works in South Bend during the present year. The plant will provide an increased manufacturing space of 2,000,000 sq. ft., and will consist of machine shop, foundry, forge shop, assembling department, stamping plant, heat treatment shop, car-testing plant, tool works, etc. The power plant having a generating capacity of about 8000 kw., has been completed.

CHICAGO, ILL.—Arrangements are being made by the railroads interested in the new $3,000,000 union station in Chicago for resuming work on the station. Construction work was started several years ago, but was delayed first by a strike and later by the war.

CHICAGO HEIGHTS, ILL.—Plans are being prepared by R. C. Clark, architect, for the construction of a fertilizer plant, 240 ft. by 520 ft., on State Street and Chicago Heights Terminal Transfer Railroad, to cost about $500,000, for the Armour Fertilizer Works, Union Stock Yards, Chicago.

ELIZABETHTOWN, ILL.—The installation of an electric lighting system for the village is under consideration by the Village Council. Richard F. Taylor is president of the village board.

LEWISTOWN, ILL.—The Council is considering the installation of a municipal lighting system in Lewistown.

LADYSMITH, WIS.—Plans have been prepared by the L. C. Meyers Company, engineer, 53 West Jackson Boulevard, Chicago, Ill., for the construction of a dam near Ladysmith for the Big Falls Water Company. The cost is estimated at about $2,000,000.

MILWAUKEE, WIS.—The construction of a new ice machine house is contemplated by the Plankinton Packing Company in connection with the proposed improvements to its plant at Muskego Avenue and Canal Streets, to cost about $200,000. Harry C. Culver is manager.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has been asked by the County Commissioners to submit a bid for the installation of electric lamps on Burnham Street between the city limits of Milwaukee and the city limits of West Allis.

MINNEAPOLIS, MINN.—Contracts, it is reported, will soon be awarded by the Northwestern Telephone Exchange Company, Fifth Street and Third Avenue, for the erection of an eleven story ,132-ft. by 147-ft. exchange building on Third Avenue South, between Fourth and Fifth Streets.

CUMBERLAND, IOWA.—Extensive improvements are contemplated by J. V. White, owner of the local electric light plant, which will include the erection of electric transmission lines to Bridgewater and Massena.

COLUMBIA, MO.—Application has been made to the State Legislature by the managers of the State University for an appropriation to build a gymnasium, woman's and home economics buildings and power house.

COLUMBIA, MO.—Plans are under consideration for the erection of a machine shop at the University of Missouri. J. P. Jamieson, Security Building, St. Louis, is engineer.

FULTON, MO.—The board of managers of the State Hospital will petition the State Legislature for an appropriation for power plant. The cost of the power station is estimated at $40,000 and the equipment at $27,000.

MILLER, MO.—The Council has granted J. P. Alexander a franchise to install an electric lighting system in Miller. The Delco system, it is understood, will be used.

ODESSA, MO.—Plans are under consideration for disposing of the municipal electric light plant and entering into a contract with the Green Light & Power Company of Pleasant Hill for electricity for a period of twenty years.

PITCHER, MO.—The Pitcher Zinc Company is considering the purchase of four additional storage-battery locomotives in the spring.

ST. JOSEPH, MO. — Investigations of the electric power situation in St. Joseph are being made by electrical engineers from Chicago with a view, it is reported, to the installation of an independent power plant by the packing industries to supply service to the packing houses of South St. Joseph.

BEATRICE, NEB.—Plans are under consideration by George Steinmeyer of Beatrice, it is reported, for the construction of a hydroelectric plant on the Blue River, near Barneston, 20 miles south of Beatrice. The proposed plant will cost about $125,000 and will supply electricity in Blue Springs, Wymore and other towns and cities.

CANEY, KAN.—The property of the Caney Electric Light Compny, recently sold at a foreclosure sale, was purchased by the bondholders for $23,000. At present nothing will be done in regard to a new plant. The town is considering an expenditure of at least $25,000 for a new lighting plant from which transmission lines will be extended to adjacent towns.

DOWNS, KAN.—The Downs Electric Light & Power Company has sold its distributing system to the city of Downs. Electricity to operate the system will be purchased from the United Light & Power Company of Downs, recently organized.

ELDORA, KAN.—Negotiations are under way between the city officials and the Kansas Gas & Electric Company for the installation of seventy-five additional street lamps and for ornamental lamps on two additional blocks.

HILLSBORO, KAN.—Bids will be received by P. C. Hiebert, vice-president, Hillsboro, until Feb. 12 (extension of date from Jan. 27) for construction of college building for Tabor College, to cost about $100,000. Heating, plumbing and electrical work will be awarded in a separate contract later. William Mampe, Sheidley Building, Kansas City, Mo., is architect.

Southern States

DURHAM, N. C.—The City Council is considering submitting to the voters, the proposal to issue $90,000 in bonds to establish an ice plant.

RALEIGH, N. C.—The capital stock of the Palmetto Power & Light Company has been increased from $200,000 to $500,000.

WILSON, N. C.—The flour mill and the generator, owned by L. P. Woodward, which supplied electricity for lighting the country club have been destroyed by fire.

LOWNDESVILLE, S. C.—Contract has been awarded by the Lowndesville Light & Power Company to H. M. Schumpert for the erection of transmission lines at $5,000. All material except lamps for streets and residences has been purchased.

CORDELLE, GA.—The City Council is considering the construction of a municipal electric light plant.

KNOXVILLE, TENN. — The Southern Machinery Company, Empire Building, would like to receive prices on a 150-kw. to 200-kw. direct-current generator and engine, direct-connected.

LONG BEACH, MISS.—Additional electric equipment, it is understood, will be purchased by the R. Inglis Manufacturing & Commission Company.

NATCHEZ, MISS.—The City Council has engaged an engineer to prepare estimates of cost of the installation of a municipal electric light plant in Natchez.

PICHER, OKLA.—Surveys, it is reported, have been made by J. McNichols for an electric belt railway to connect Picher, Couthat and Cardin.

GALVESTON, TEX.—The Western Union Telegraph Company has petitioned the City Council for an amendment of its franchise allowing all remaining overhead wires to be placed underground. The cost is estimated at about $67,000. Material, it is understood, has been purchased.

HEMPSTEAD, TEX.—Improvements to the municipal electric light plant, including the purchase of an additional engine, are under consideration.

IRVING, TEX.—The Texas Power & Light Company contemplates the installation of a transformer to furnish electricity for the entire town.

TEAGUE, TEX.—The City Council has granted T. L. Childs and associates a franchise to construct and operate an electric light and power plant in Teague.

Pacific and Mountain States

SEATTLE, WASH.—Plans have been prepared by the Puget Sound Traction, Light & Power Company for completing the interior of the substation at Seventh Avenue and Jefferson Street, which was destroyed by fire last November.

SEATTLE, WASH.—The City Council recently passed two ordinances over Mayor Hanson's veto, appropriating $10,000 to complete the Ballard substation and $15,000 for a site for a substation on Spokane Street. The ordinances were passed on the recommendation of J. D. Ross, superintendent of lighting, who states that both projects are necessary and should be provided as soon as possible.

SEATTLE, WASH.—The Light Department has asked for the sale of $750,000 in bonds out of the total issue of $1,755,000 authorized last fall to provide for the following construction work during the present year: Substation on Spokane Street at Whatcom for the purpose of operating the elevated railway, to cost $165,000; completion of Ballard substation to furnish electricity to the northwest part of the city and to operate the north end of the municipal railway, $30,000; for strengthening the present distributing system to relieve the overloaded condition of distributing station transformers, $50,000; for general construction work within the city limits, $100,000; for completing sealing operations at the Cedar River dam (on which about $200,000 has already been spent), $200,000; construction of a new 6-ft. pipe line from the dam to the power house at Cedar River, $125,000; for an interconnection with the lines of the Puget Sound Traction, Light & Power Company, $75,000. The remainder of the $1,755,000 will be expended during the next three years in building a substation at the north end costing about $250,000 and another at the south end, to cost about $200,000, and in other additions to the lighting system to take care of the power to be secured from the Skagit project.

SPOKANE, WASH.—Plans are under consideration by the Great Northern Railway Company for installing a block signal system in the Cascade division between Skykomish and Delta, to cost about $166,000. The company is now constructing a block signal system between Hillyard and Leavenworth, to cost about $200,000.

EL CENTRO, CAL. — The Southern Sierras Power Company of Riverside is planning to erect an electric transmission line from El Centro to Calexico, a distance of 30 miles, to cost about $30,000, Bids, it is understood, will soon be asked for the work.

LOS ANGELES, CAL.—The Southern California Power Company contemplates an expenditure of about $20,000,000 for extensions to its system, to include the construction of a hydroelectric plant, to develop 150,000 additional horsepower, the erection of electric transmission lines and distribution lines throughout southern California.

PASADENA, CAL.—The City Commission has adopted a resolution providing for the purchase of the local distributing system of the Southern California Edison Company for $510,108, subject to the approval of the voters and acceptance of the offer by the corporation.

STOCKTON, CAL.—Application has been made to the State Railroad Commission by the Western States Gas & Electric Company for authority to issue $450,000 in bonds, the proceeds to be used for reimbursing the company for expenditures already made and to provide funds for construction work planned for the coming year.

TULARE, CAL.—The Mount Whitney Power & Electric Company has begun work on the proposed changes and improvements to its local system, involving an expenditure of about $82,000. Of this amount $60,000 will be expended in extending transmission lines to meet the increasing demand of ranchers for power for pumping purposes; another $17,000 will be spent in converting the Tulare lines from two-phase, 6600-volt system to three-phase, 11,000 volts, and $5,000 for two new transformers for the local substation.

GARIBALDI, ORE.—Orders have been placed by the Cummings Lumber Company of Garibaldi for electric generating equipment and motors, consisting of one 1000-kw., three-phase, 2300-volt, Curtis turbo-generator and one 320-kw., three-phase, 2300-volt engine-driven unit for its new mill at Garibaldi. For a time the company will purchase energy from the Coast Power Company of Tillamook.

HELPER, UTAH.—The City Council is planning to rebuild penstock and intake works for the hydroelectric plant, recently destroyed by flood. The cost is estimated at about $10,000.

FLORENCE, ARIZ.—Plans are being prepared by Burns & McDonnell, consulting engineers, Inter-State Building, Kansas City, Mo., for improvements to the municipal lighting system waterworks, to cost about $80,000.

HUMBOLDT, ARIZ.—The Humboldt Improvement Company is contemplating the construction of an electric light plant and waterworks system, to cost about $200,000.

SUPERIOR, ARIZ.—The Queen Copper Company is contemplating the installation of a power plant, the equipment to include a 100-hp. engine, compressor and hoist. W. E. Defty is consulting engineer.

CUT BANK, MONT.—Steps have been taken by local business men to establish an electric light plant in Cut Bank. Application, it is understood, will soon be made to the City Council for a franchise for same.

GILMAN, MONT.—A committee has been appointed by the Commercial Club to consult with local business men relative to establishing an electric lighting plant in Gilman.

Canada

SYDNEY, N. S.—Contract has been awarded by the Dominion Iron & Steel Company for construction of power station to the Foundation Company, Ltd., 224 St. James Street, Montreal, Que. The proposed power plant will have a generating capacity of 1150 kw.

ELORA, ONT.—The construction of an electric railway to connect Elora and Kitchener is reported to be under consideration.

HAMILTON, ONT.—The Hydro-Electric Power Commission of Ontario has signified its readiness to build a Toronto, Hamilton & Niagara Falls radial railway, provided that the necessary by-laws are carried by the city of Hamilton and the municipalities of Saltfleet and Nelson.

LONDON, ONT.—The installation of an automatic municipal telephone system is under consideration by the city authorities.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Fort Smith, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St. East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Chicago.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. C. Hoffman, St. Paul Gas Light Co., St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass., June.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual meeting, Albuquerque, N. M., Feb. 17-19.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary H. A. Lane, 611 State National Bank Building, Oklahoma City. Annual meeting, Feb. 13, 14 and 15, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Greenwood, S. C., April.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis. Annual meeting, Milwaukee, March 25-27.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 17, 1918)

1,287,812. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; Charles E. D. Ahlm, Cleveland Heights, and Harry Y. Hall, Cleveland, Ohio. App. filed April 17, 1918. May be easily disconnected, removed and replaced, allowing the ready substitution of new brushes.

1,287,829. AUDIBLE INDICATING DEVICE; Harold B. Barnes, Denver Col. App. filed Feb. 24, 1917. Used in connection with a snap switch for controlling electric circuits.

1,287,831. SYSTEM FOR COMPENSATING FOR DIFFERENCES OF POTENTIALS; Henry M. Bascom, Brooklyn, N. Y. App. filed May 17, 1917. To insure proper operation of relays or other signal-controlling devices whose action depends upon a balance of electrical or magnetic forces.

1,287,847. SIGNALING DEVICE; John Bond, Brooklyn, N. Y. App. filed April 24, 1918. For use on automobiles, autotracks and other vehicles; indicates the driver's intention to turn to the right or to the left, to slow up or to stop.

1,287,849. ELECTRIC FURNACE; William K. Booth, Chicago, Ill. App. filed April 4, 1918. An improved wall contact or wall terminal and method of construction is provided.

1,287,851. ELECTRIC ENERGY CONVERTER AND METER; Augustus J. Bowie, Jr., San Francisco, Cal. App. filed March 12, 1914. Means for deriving power from and for effecting the indication of or recording of the current voltage or power in high-tension lines.

1,287,886. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, and Charles L. Goodrum, Brooklyn, N. Y. App. filed Oct. 6, 1916. Means for preventing wrong connections by false impulses caused by the careless manipulation of the calling substation apparatus.

1,287,896. ILLUMINATED WEIGHING SCALE; Samuel G. Crane, Toledo, Ohio. App. filed Jan. 27, 1915. For use with weighing scales of the double pendulum type.

1,287,907. METHOD OF AND APPARATUS FOR LOCATING SUNKEN BODIES; Patrick B. Delany, South Orange, N. J. App. filed Dec. 27, 1916. Electrically operated detecting or indicating devices are included in a circuit also including an electrode which is lowered into the water and moved over the bottom or through the water until the object is found.

1,287,913. ELECTRICALLY HEATED RADIATOR; Frank L. Dietzel, West Nashville, Tenn. App. filed June 18, 1918. The water may be heated to the boiling point directly in the radiator, producing steam under sufficient pressure to effect the desired radiation.

1,287,918. PORTABLE ELECTRIC LIGHT; John T. Drufva, Longmeadow, Mass. App. filed July 31, 1917. Accidental creation of a circuit through the lamp and battery by the contact of the device with metal articles is prevented.

1,287,919. PORTABLE ELECTRIC LIGHT; John T. Drufva, Longmeadow, Mass. App. filed July 31, 1917. To be held in the hand and lighted by the manual movement of a slide on the exterior casing.

1,287,952. CURRENT CONTROLLER; Benjamin F. Gardner, Chicago, Ill. App. filed July 24, 1916. Invention relates to an adjustable resistance member and a convenient unitary housing for the same.

1,287,965. COMBINATION TERMINAL BOX AND FIXTURE STUD; William M. Gore, Toledo, Ohio. App. filed Sept. 1, 1917. The box and stud may be used together or separately as desired.

1,287,970. METHOD AND ARRANGEMENT OF APPARATUS FOR THE DETECTION AND MEASUREMENT OF ALTERNATING CURRENTS AND OTHER CURRENTS OF PERIODIC NATURE; Heinrich Greinacher, Zurich, Switzerland. App. filed Dec. 2, 1916. Applying an alternating current directly to a selenium cell affects the electrical resistance of the selenium.

1,287,972. RETARDED ALARM VALVE AND THE LIKE; Allan J. Gross, Chicago, Ill. App. filed Dec. 10, 1914. Gives an alarm in the event of a sprinkler head opening from fire or other causes, and prevents false alarms ordinarily resulting from water hammer and other fluctuating pressure conditions in the water supply of sprinkler systems.

1,287,982. MODULATING SYSTEM; Ralph V. L. Hartley, Brooklyn, N. Y. App. filed Feb. 16, 1917. To improve the quality of speech transmitted by modulators of the magnetic type.

1,287,988. ELECTRIC STARTING AND SUPPLY SYSTEM FOR AUTOMOBILES; John A. Heany, Flint, Mich. App. filed July 28, 1910. A dynamo-electric machine is so arranged and wound that it may act either as a compound-wound motor for starting the engine or as a differentially wound generator for providing current at a substantially constant potential for load circuits.

1,287,989. DYNAMO-ELECTRIC STARTING, LIGHTING AND IGNITION MECHANISM FOR AUTOMOBILES; John A. Heany, Flint, Mich. App. filed Aug. 1, 1910. Means furnished for translating electrical energy for starting an engine and further electrical means for furnishing electrical energy for the starting mechanism and the lighting and ignition system used in an automobile.

1,287,992. PARTY-LINE AUTOMATIC TELEPHONE SYSTEM; Harry E. Hershey, White Water, Kan. App. filed Nov. 23, 1913. Means provided for calling back on a line without necessitating the removal of the guarding potential.

1,288,016. INSULATING DEVICE; Chester N. Johnson, Chicago, Ill. App. filed May 29, 1913. To be secured at the end of a pipe or conduit to prevent fraying of the wire insulation and separate the different leads and insulate them.

1,288,017. TIME-ELEMENT DEVICE; John L. Johnson, Milwaukee, Wis. App. filed June 12, 1911. The time element is made to vary inversely as the abnormality of the controlling condition.

1,288,019. ELECTRICAL MEASURING INSTRUMENT; Manfred J. Johnson, Naugatuck, Conn. App. filed Jan. 24, 1918. Means furnished for compensating the error in the indications of the instrument produced by variations of temperature of the surrounding atmosphere.

1,288,024. BRACKET FOR ELECTRICAL APPARATUS; Julian H. Kendig, Pittsburgh, Pa. App. filed March 11, 1915. For supporting switch terminal and other boxes used for retaining electrical apparatus.

1,288,044. ELECTRIC IMMERSION HEATER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918. Is of comparatively high electrical resistance and also very compact.

1,288,045. FOOT WARMER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed March 14, 1918. Designed for use by aviators and motorists and others subject to exposures of extreme cold.

1,288,046. WEATHERPROOF ELECTRICAL HEATER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed June 15, 1918. An armored heating element is associated with a terminal box in such a manner that access of water to the electrical connections within the box is substantially prevented.

1,288,069. ELECTRIC WATER HEATER; Antonio Longoria, Cleveland, Ohio. App. filed Feb. 21, 1916. A plurality of heating elements may be supplied between the end plates so as to increase or decrease the capacity of the heater.

1,288,094. INDICATING DEVICE OR THE LIKE; Harold P. Manly, Chicago, Ill. App. filed Dec. 14, 1915. For indicating or determining and assisting in the removing of abnormal conditions or faulty operation of devices, elements or combinations of parts, whose construction, operation, action, care or use depends upon the principles of mechanical, electrical, physical or chemical science.

1,288,098. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Feb. 5, 1916. A switch is provided which can perform the functions of both a selector and a connector.

1,288,117. CURRENT MODULATOR; Francesco Morando, Rome, Italy. App. filed Sept. 1, 1914. Relates to the generation of variations of current in electric circuits by physical or mechanical actions.

1,288,128. ELECTRIC CIRCUIT CONTROL; Howard J. Murray, Brooklyn, N. Y. App. filed May 12, 1917. Particularly relates to a circuit closure constituting part of an automatically actuated signaling device for use on motor cars to indicate change in rate of travel.

1,288,160. CONNECTOR FOR BATTERIES; Ward S. Perry, Chicago, Ill. App. filed April 9, 1917. Is adjustable and used for connecting lead wires to a storage battery in an electric lighting and starting mechanism for an automobile.

1,288,240. ELECTRIC FURNACE; Leo L. Simpson, Seattle, Wash. App. filed July 24, 1915. Improvements consist of cooling means comprising a water-jacketed head carbon electrode, water-jacketed furnace cover and water-jacketed copper bottom of the carbon electrode.

1,288,274. HYDRAULIC TRANSMISSION MECHANISM; August Sundh, Hastings-Upon-Hudson, N. Y. App. filed March 12, 1914. Relates to a system of control and is particularly adapted to mechanism comprising a pump operated by a prime mover such as an electric motor.

1,288,275. ELECTRICAL CONTROL SYSTEM FOR HYDRAULIC TRANSMISSION; August Sundh, Hastings-Upon-Hudson, N. Y. App. filed March 14, 1914. For controlling a power unit comprising a fluid motor, pumping mechanism for supplying fluid under pressure to the fluid motor, and a prime mover such as a motor for driving the pumping mechanism.

1,288,303. GROUNDING DEVICE; John C. Vogel, Philadelphia, Pa. App. filed May 29, 1914. Consists of a receptacle adapted to receive and retain a suitable hygroscopic compound and to keep it practically in free communication with the earth surrounding the box.

1,288,304. SAFETY ELECTRIC LIGHT; George W. Wacker, Rutherford, N. J. App. filed May 5, 1917. Provision is made for preventing the ignition of combustible or explosive gases or vapors from the incandescent lamp filament in the event of the breaking of the lamp bulb.

1,288,358. IMPULSE-TRANSMITTING MECHANISM; James A. Wotton, Montclair, N. J. App. filed July 26, 1917. A rotatable toothed wheel engages contact springs to open and close a circuit associated with it.

1,288,365. COIL SUPPORT; Charles R. Young, Bloomfield, N. J. App. filed April 24, 1917. Relates to the mounting of electrical apparatus such as loading coils, repeating coils, transformers and the like within a suitable casing or housing.

1,288,373. ENGINE STARTER; Vincent Bendix, Chicago, Ill. App. filed Dec. 30, 1912. Particularly suited for a gas engine.

1,288,381. ELECTRIC SWITCH; John E. Cavanagh, Meriden, Conn. App. filed March 30, 1918. For controlling the lighting circuits of automobiles.

1,288,386. AUTOMATIC GUN-FIRING DEVICE; Fernan Conill, Port Jefferson, N. Y. App. filed Sept. 28, 1917. For automatically firing a gun when an object is in perfect alignment with the gun sight.

1,288,411. TELEPHONE SYSTEM; Henry J. Herink, London, Eng. App. filed June 2, 1917. Means provided for preventing the registering of calls against a caller under certain conditions.

1,288,418. MOTOR-CONTROL SYSTEM; John D. Ihlder, New York, N. Y. App. filed July 22, 1915. For electric motors used in operating elevators and the like.

1,288,444. ELECTRIC SOLDERING IRON; Edward Schwartz, New York, N. Y. App. filed Feb. 14, 1918. Comprises relatively few parts, each of which is self-contained so that it may be replaced without difficulty.

1,288,449. TELEPHONE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed Oct. 18, 1913. To shorten the time and lessen the trouble of operation.

1,288,452. CUT-IN AND CUT-OUT DEVICE FOR ELECTRIC GENERATORS; Herbert C. H. Smyth, London, Eng. App. filed Oct. 26, 1915. Comprises magnet coils having a single winding and a keeper in connection with carbon contacts arranged together on a suitable base which also carries an adjusting contrivance for the keeper.

1,288,454. TELEPHONE-EXCHANGE SYSTEM; Harold D. Stroud, Chicago, Ill. App. filed July 25, 1901. Automatic means provided for connecting subscribers' telephone lines with cord circuits, these cord circuits being also provided with manually operated means for uniting the same with telephone lines for completing connection between subscribers.

1,288,456. TELEPHONE ATTACHMENT; Robert C. Groh, St. Paul, Minn. App. filed March 23, 1917. To light up the number dial when a telephone of an automatic system is being used.